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# PROGRESSIVE MEDICINE

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES  
AND IMPROVEMENTS

IN THE

MEDICAL AND SURGICAL SCIENCES

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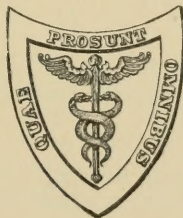
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VOLUME I. MARCH, 1915

SURGERY OF THE HEAD AND NECK—SURGERY OF THE THORAX, EXCLUDING DISEASES  
OF THE BREAST—INFECTIOUS DISEASES, INCLUDING ACUTE RHEUMATISM,  
CROUPOUS PNEUMONIA, AND INFLUENZA—DISEASES OF CHILDREN  
—RHINOLOGY AND LARYNGOLOGY—OTOLOGY



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# PROGRESSIVE MEDICINE.

MARCH, 1915.

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## SURGERY OF THE HEAD AND NECK.

By CHARLES H. FRAZIER, M.D.

### THE CEREBROSPINAL FLUID AND ITS RELATION TO INTRACRANIAL LESIONS.

WE can scarcely lay too great stress on the importance of an intimate knowledge of the physiology of the cerebrospinal fluid in health and disease, if we are to cope successfully with intracranial lesions. The accumulation of cerebrospinal fluid in abnormal quantities is a factor which must be reckoned with not only in congenital hydrocephalus, but in many other pathological conditions, such as tumors, inflammations, infections, anomalies and defects, and not infrequently in cases of trauma and epilepsy, and the success or failure of the treatment of these lesions depends to a certain extent upon the method adopted for dealing with the excessive amount of fluid, since this may be the determining factor in the mortality rate quite as often as the primary lesion. Despite the fact that up to the present time numerous procedures have been devised for the treatment of hydrocephalus, both congenital and acquired, they have been almost equally unsuccessful, and the reason for failure lies in the fact that the treatment has necessarily been symptomatic and not founded upon a firm scientific basis. The key to the situation must lie in the cause of the excessive accumulation of fluid, but through all the years since Hippocrates first tapped the ventricles, the pathogenesis of this condition has remained a mystery.

However, there has been, of late, a revival of interest in the cerebrospinal fluid, and, as the result of our recent physiological investigations and clinical observations, we have gleaned sufficient knowledge to explain, at least partially, these etiologic factors and to devise methods of treatment which need no longer be purely empirical. Since a superabundance, rather than a diminution, of fluid has been the predominate factor in every pathological condition of the cerebrospinal fluid thus

far known, it is self-evident that a disturbance of the balance between formation and absorption is responsible for the abnormal increase. Therefore, if we are to deal with the problem at the source,—that is influence the excessive formation of the fluid, or supplement its defective absorption,—we must have a thorough understanding of the processes of formation and absorption. It is with this end in view that we have been carrying on a series of investigations which in the course of these pages we will review briefly since the principles thereby revealed will, we trust, throw light on this baffling problem and suggest more successful methods of treatment for many intracranial lesions.

**Anatomy.** By way of introduction to this discussion, we refer to a few facts of historical interest in the evolutionary study of the cerebrospinal fluid. It was first mentioned in 1764, by Cotugno, who described it in the human cadaver as a transparent fluid bathing the nervous centres, but its presence during life was still doubtful. In 1766, Haller found it in the spinal canal and believed it to be a transudate, similar to the fluid in the peritoneum, but he was entirely ignorant of the fact that it circulated, or that there was a relation between this fluid and that in the ventricles. It was not until 1840, that Magendie discovered a connection between the ventricles and the subarachnoid space by means of the foramen which has been named for him. This gave a new impetus to investigation in this field, and we have the work of Claude Bernard and others following upon the revelations made by Magendie, all contributing to make our knowledge of the anatomy and physiology of this fluid, which has no analogy in the entire human body, more complete.

Under normal conditions, the cerebrospinal fluid circulates freely between the ventricles of the brain and the cerebral and spinal subarachnoid spaces, the principal means of communication being the foramen of Magendie at the apex of the fourth ventricle and the foramen of Luschka at the external lateral recesses of the same ventricle. The cerebrospinal fluid fills all the space in the cranial cavity not occupied by nervous tissue and vessels. The arachnoid, unlike the pia, follows the general outline of the skull rather than that of the brain, thus bridging over the subarachnoid cisterns, which are filled with cerebrospinal fluid. We must not, however, get an erroneous idea of the size of these arachnoidal cisterns, for as Hill<sup>1</sup> states, "the cerebral subarachnoid space is a potential rather than an actual space, except in those few places where inequalities of the brain surface are rounded off by small collections of fluid beneath this membrane," the fluid moistening the surface of the brain being little more in amount than the synovial fluid in a joint. The spinal subarachnoid space, especially about the cauda equina is relatively larger, so that compression of the

<sup>1</sup> System of Medicine: Allbutt and Rolleston, vol. viii.

cord may be prevented during the various movements of the spinal column. The normal amount of cerebrospinal fluid in an adult of ordinary height is 120 to 150 c.c. (Magendie, Mott, and others), though

FIG. 1

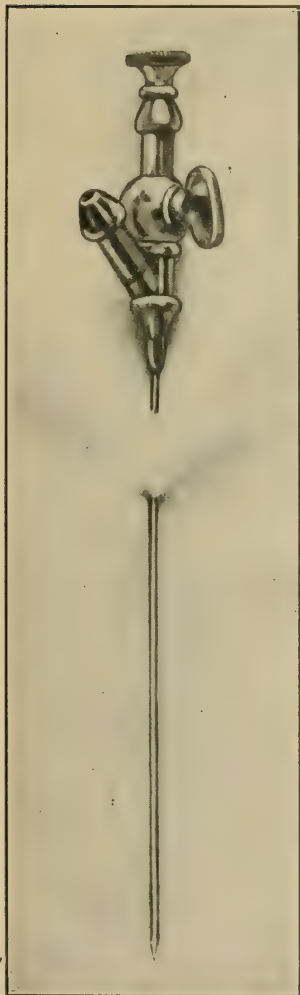


FIG. 2

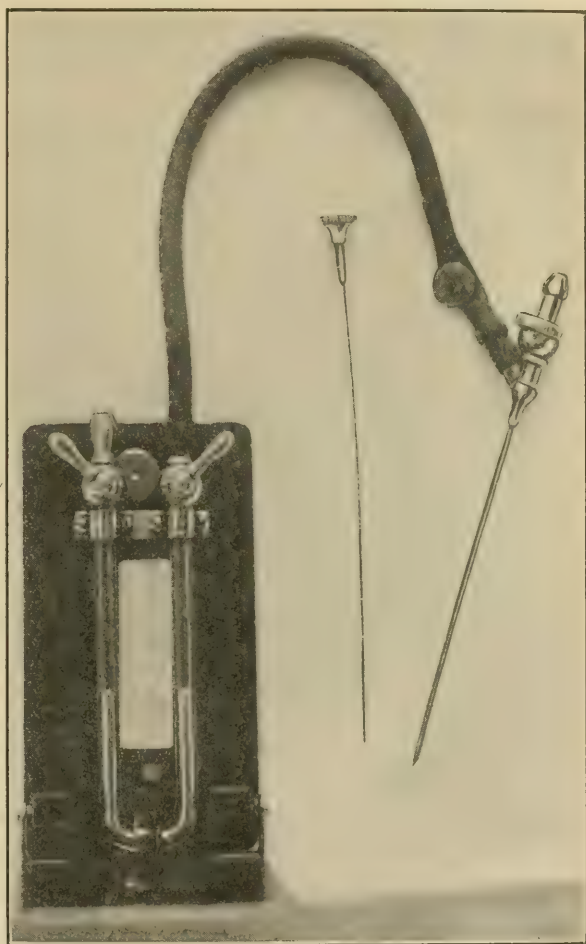


FIG. 1.—Author's special cannula for lumbar puncture. The outlet at the side is for connection with the manometer.

FIG. 2.—Author's pocket mercurial manometer attached to cannula. When folded up, the U-tube is protected and the mercury is prevented from escaping by closing the cocks.

it varies greatly in amount in certain pathological conditions of the nervous system. Normally, we find the pressure registers 100 mm. of water, or with the mercury manometer (see Figs. 1 and 2), which I

prefer, about 6 mm. Natural variations from the normal occur during inspiration and expiration, the former lowering, the latter raising it, as the blood is dammed back from the right auricle and vena cava into the cerebral sinuses.<sup>1</sup>

The cerebrospinal fluid secreted in the ventricles passes, under normal conditions, through the foramen of Magendie and Luschka, into the entire subarachnoid space. Magendie discovered that this movement from the cranium to the spinal canal was synchronous with each cardiac systole, a fact which has since been corroborated, by the experiments of François-Franck, and others.

Though for a long time the cerebrospinal fluid was looked upon as ordinary lymph, bathing the nervous tissues, it is now a well known fact that there are no true lymphatic vessels in either the brain or the spinal cord; the cerebrospinal fluid being quite different, chemically and physically, from both lymph and the liquid found in the serous cavities, such as the pleura and peritoneum. To be sure, there are lymphatics in the perivascular spaces in the tunica adventitia of the bloodvessels, these spaces communicating with the cellular spaces and the subarachnoid space, as has been brought out by the anatomical studies of Key and Retzius, and Schwalbe, but there are no lymphatic glands (Hill and Mott). These lymphatics could scarcely serve as the medium of exchange between the blood and the nervous tissues. Therefore, the question naturally arises as to what is the ambient medium. Mott, and Dixon and Halliburton (see p. 21) have tried to prove that this is one of the functions of the cerebrospinal fluid.

**Origin of the Cerebrospinal Fluid.** That the cerebrospinal fluid is the secretory product of the cubical cells of the choroid plexus is now accepted by most research workers, although this view has been based upon chemical analyses of the fluid, and histological changes in the choroid plexus, rather than upon an absolute anatomical or physiological proof. Willis, in 1664, remarked upon the glandular nature of the choroid plexus, but it was not until 1853 that Faivre first ascribed an active secretory function to the ependymal cells covering the choroid plexus, thereby establishing a definite relation between them and the cerebrospinal fluid. This same theory was advanced by Luschka a few years later, and since that time has been strongly supported by the researches of Findlay, Kingsburgh, Cavazzani, and Capelleti, of Pettit and Girard, and of Mott. In fact, there has been little doubt as to the true nature of the choroid plexus since Pettit and Girard published, in 1902, their monograph on the secretory function and morphology of the choroid plexus. These authors, by careful study of the plexuses in different classes of vertebrates, and by observation of the histological changes following the administration of substances with a hyper-secreting effect, proved that the choroid plexus has a definite secretory function.

<sup>1</sup> Frazier, Journal of American Medical Association, July 25, 1914.

Mott<sup>1</sup> after carefully comparing the lachrymal gland with the epithelial cells of the choroid plexus, has found a strong similarity between the two glands. And, on the basis of his own histological studies and the evidence which has been brought forth by others, he has come to the conclusion that the choroid plexus is a gland with an external secretion, but with an internal destination—a mixed type of gland intermediate between a ductless gland and a gland with a duct; its formation being affected in an inverse manner, epithelial invagination for a gland with an excretory duct, ependymal invagination for the choroid plexus.

A still further proof of the secretory function of the cells of the choroid plexus is offered by the recent intra vitam staining experiments of Goldmann,<sup>2</sup> who, by investigations of the fetal nervous system, found that intracellular glycogen was demonstrable in the plexus cells only. This substance, however, was not held back by the cells, but was secreted drop by drop, entering the ventricular fluid and the subarachnoid space, and finally was diffused throughout the entire nervous system. In other words, the cerebrospinal fluid receives from the choroid plexus important metabolic products which are carried by the fluid to all the tissues of the central nervous system. The impermeability of the choroid plexus, as shown by our own experiments and those of Goldmann and others is a further point in favor of the secretory theory.

We found that the choroid plexus acts as a sort of filter, offering remarkable resistance to the passage into the fluid of substances *injected into the circulation*, so that no untoward nervous symptoms follow their introduction, although the plexus is brightly colored by the dye. But when the dye is injected into the subarachnoid space, the cells and ganglia of the brain and spinal cord are at once stained; the convulsions pass from the tonic to the clonic type and the animal dies.

The fact that a marked increase in intracranial pressure invariably follows interference with the outflow of the cerebrospinal fluid from the lateral ventricles is another point in favor of the plexus theory. But most convincing of all, it seems to me, is the decided increase in the rate of flow which is caused by injections of extract of the choroid plexus, and, to a less marked degree, of brain extract. This has been proved by my own experiments<sup>3</sup> and by those of Dixon and Halliburton,<sup>4</sup> who, as a result of their findings, have elaborated the hormone theory that some product of the brain's metabolism passes to the choroid plexus, and that this stimulates the epithelial cells and causes them to become active.

For some time attempts have been made to prove, by chemical analysis, that the cerebrospinal fluid is a secretion rather than a transu-

<sup>1</sup> Oliver-Sharples Lectures, *Lancet*, 1910, ii, 1 and 79.

<sup>2</sup> *Archiv f. klin. Chir.*, 1913, vol. ci, No. 3.

<sup>3</sup> *American Journal of Physiology*, 1914, xxxv, No. 3.

<sup>4</sup> *Journal of Physiology*, 1913, xlvii, 215.

date from direct filtration; Schmidt, and others, have called attention to the larger proportion of potassium salts in lymph than in cerebrospinal fluid. While careful chemical analyses show that the character and amount of the inorganic constituents of the cerebrospinal fluid are very similar to those of the blood and lymph, the fact that it contains no true albumin, no fibrinogen, and only a slight amount of protein in the form of globulin, makes it evident that we are dealing not with a simple transudation, but with a true secretion. Moreover, Hill<sup>1</sup> has shown that in the closed cranio-vertebral cavity the pressure of the cerebrospinal fluid and of the capillaries are the same, and hence that no filtration pressure can exist. Therefore, chemical analysis would lead us to look upon the cerebrospinal fluid as a *true secretion*, and the histological and physiological evidence at hand would seem to prove beyond a doubt that the cerebrospinal fluid is the *secretory product of the epithelial cells of the choroid plexus*.

In this connection, however, it is interesting to note, that certain recent writers, notably Weed,<sup>2</sup> Mestrezat<sup>3</sup> and Plaut, Rehm and Schottmüller<sup>4</sup> have come to the conclusion that the cerebrospinal fluid has a dual source. While they agree that the greater part of the fluid is derived from the choroid plexus, they feel that the perivascular systems of the nervous tissues play a small part in its formation. Lewandowsky advanced the theory that the cerebrospinal fluid originates in the vessels and tissues of the nervous system—a theory which he bases on the experimental observations of Spina who saw drops of fluid appear from the brain when blood-pressure was increased, and of Kocher, who noted a similar condition during an operation, and on the fact that there is communication between the subarachnoid space and the perivascular and perineural spaces. Indeed Hauptmann<sup>5</sup> has come to practically this same conclusion, namely, that the greater part of the cerebrospinal fluid is secreted by the choroid plexus, but that the bloodvessels of the brain and possibly the brain substance itself, share in its production. Therefore, we have not as yet entire unanimity of opinion even as to the origin of the cerebrospinal fluid.

**Production of Artificial Hydrocephalus.** I have found, as have several other investigators, notably Dandy and Blackfan<sup>6</sup> and Thomas,<sup>7</sup> that the production of an artificial hydrocephalus is one of the most effective means of elucidating the various problems connected with the secretion and absorption of the cerebrospinal fluid.

<sup>1</sup> System of Medicine: Allbutt and Rolleston, vol. viii.

<sup>2</sup> Journal of Medical Research, September, 1914.

<sup>3</sup> Le Liquide Céphalorachidien, Paris, 1912.

<sup>4</sup> Leitfaden zur Untersuchung der Cerebrospinalflüssigkeit, Jena, 1913.

<sup>5</sup> Die Allgemeine Chirurgie der Gehirnkrankheiten, Part 1, by F. Krause, Neue Deu. Chir., Band xi.

<sup>6</sup> Journal of American Medical Association, 1913, vol. lxi, No. 25.

<sup>7</sup> Journal of Experimental Medicine, 1914, xix, No. 1.

In the series of experiments recently carried on by my assistant, Dr. Peet, and myself,<sup>1</sup> we succeeded in producing this condition experimentally in two ways: (1) By mechanically plugging the lower end of the aqueduct of Sylvius; (2) by effecting its closure through the medium of inflammatory products which are the result of chemical irritation. In our experimental work, we used each method separately, and a combination of the two. Our results showed that the cerebrospinal fluid is almost all, if not entirely, secreted within the ventricles, and that absorption does not take place until the fluid has escaped. The lateral ventricles, therefore, are, as the bladder, a receptacle for the storage of fluid, as well as a chamber in which it is produced. By the production of an artificial hydrocephalus, it becomes possible, as has been proved by Dandy and Blackfan and by our own experience,<sup>2</sup> to differentiate between the various types of hydrocephalus, those with obstruction and those without obstruction of the ventricles. Dandy and Blackfan<sup>3</sup> produced an internal hydrocephalus experimentally first by occlusion of the aqueduct of Sylvius, secondly by ligation of the vena Galena magna, and, as the result of these experiments, they concluded that the cerebrospinal fluid forms in the ventricles at least more rapidly than it is removed, and that the aqueduct of Sylvius is necessary for its escape. In Thomas'<sup>4</sup> experiments, he produced an internal hydrocephalus by injecting a foreign substance (aleuronat) into the ventricles. There was little or no dilatation during the first week, inasmuch as the outflow of the fluid was not obstructed. But as soon as the chronic stage of the inflammatory process was reached, obstruction and the resulting dilatation were observed, with the clinical picture typical of increased intracranial tension. The dilatation appeared slowly and reached its maximum in about two months. The obstruction causing the internal hydrocephalus may occur at the foramen of Magendie, the foramen of Monroe, or in the aqueduct of Sylvius.

**Pressure of the Cerebrospinal Fluid.** In the experiments carried on in my laboratory, we<sup>5</sup> observed that the normal pressure of the cerebrospinal fluid varies as the pressure in the venous sinuses, and is practically identical with it. The pressure oscillates, however, under certain normal and abnormal conditions. In the first place, there are slight variations which are due to the effect of inspiration and expiration on venous pressure, but these may be arrested by a slight increase of intracranial tension, as we have demonstrated in two ways: (1) Under ether anesthesia a large tube covered at its inner end by a thin rubber bag was distended with air or water; the oscillations stopped immediately. (2) A needle was inserted into the subarachnoid space

<sup>1</sup> American Journal of Physiology, 1914, vol. xxxv, No. 3.

<sup>2</sup> Ibid.

<sup>3</sup> American Journal of Diseases of Children, 1914, vol. viii, No. 6.

<sup>4</sup> Loc. cit.

<sup>5</sup> Frazier and Peet, loc. cit.

and attached to a burette. When a column of water was introduced into the burette, under a pressure only slightly in excess of the venous pressure, the oscillations were arrested.

More marked, of course, are the variations in cerebrospinal pressure which occur under abnormal conditions, such as disturbances of the circulation or the development of certain pathological processes. We have found, as the result of our experiments, that closure of the carotid circulation causes an immediate, though transitory, fall of cerebrospinal pressure, while obstruction of the venous circulation is followed by an increase in pressure more or less constant. These findings are in accord with conclusions to which Hauptmann<sup>1</sup> has arrived.

We found, moreover, in the course of our experiments, that, while normally the cerebrospinal fluid is secreted under a pressure equal to the cerebral venous pressure, when there is a free escape of fluid, as in cases of basal fracture, the pressure falls, even to zero. Under such circumstances the fluid must be formed under a pressure lower than in the veins of the choroid plexus, so that the question arises as to whether the fluid under these conditions may not pass through the choroid plexus as a transudate, a view which is held by Hill and others. This may explain the enormous amount of fluid which may escape from cerebrospinal fistulæ, and the diminution in the total solid, which has been proven by chemical analysis, adds weight to this assumption.

The effect of increase in the fluid pressure in different parts of the cerebrospinal system is interesting and may explain some of the cases of hydrocephalus due to brain tumors. We found that if a column of fluid is introduced through a needle inserted into the cisterna magna, at a pressure considerably in excess of the normal venous pressure, the mid-brain is forced upward, blocking the isthmus of the tentorium cerebelli. This prevents any fluid passing from the posterior fossa forward over the cerebral cortex. This phenomenon was further demonstrated by exploring the parietal or frontal region through a trephine opening; in neither region could any of the fluid introduced into the posterior fossa be seen escaping over the cerebral cortex.

In this experimental observation we find a possible explanation of some of the phenomena we have observed in cases of brain tumor. It is not rare to find a tumor at the base of the brain, which does not press upon the aqueduct of Sylvius nor obstruct the foramen of Magendie, but which, nevertheless, is associated with a hydrocephalus, and it seems reasonable to assume that the tumor may have elevated the midbrain sufficiently to block the passage through the tentorium cerebelli. Since, as we will show later, the cerebrospinal fluid is absorbed from the entire subarachnoid space, the exclusion of so large an absorptive area must result in one of two conditions; either the fluid will

<sup>1</sup> Loc. cit., p. 2.

have to be absorbed much more rapidly from the remaining area or a hydrocephalus will result.

Tilman<sup>1</sup> noted a decided increase in cerebrospinal pressure during an epileptic attack (2 mm. to 50 mm.). He further notes that, in spite of the frequency of atrophy or shrinking of the brain in epileptics, there is sometimes increased intracranial tension in these cases. This fact may be attributed to a disturbance of the balance between the secretion and absorption of the fluid or to the filling of the extra space with fluid when there is either atrophy or defective development of the brain. In two cases of this nature, he had found sufficient pressure to hold a bone graft out in normal position. It is more usual, however, for the fluid to collect in the subarachnoid space than in the ventricles when the brain is atrophied; hence the slight degree of pressure in most instances. We will have an opportunity later to discuss the relation of brain tumors and other lesions to cerebrospinal pressure, and also the pathological effects of increased intracranial tension on the functions of certain important centres in the brain.

Although it is evident that many problems connected with the pressure of the cerebrospinal fluid remain unsolved, nevertheless it has been proved beyond a doubt that the cerebrospinal pressure varies directly with the pressure of the venous sinuses and is practically identical with it—a statement which is of considerable import when taken in relation with the problems of absorption, and confirms the observations, which have been made to prove that the greater part of the fluid is taken up by the venous, rather than by the lymph, channels.

**Rate of Secretion.** There is abundance of evidence, both clinical and experimental, to prove that the cerebrospinal fluid is being constantly secreted and constantly escaping, but there is as yet no concordance of opinion as to the total amount which is formed each day under normal conditions. It is a well-known fact, however, that if the fluid is allowed to escape, it is secreted more copiously, since the pressure within the cerebrospinal cavity falls to zero, while the cerebral capillary pressure remains unaltered, and transudation from the capillaries becomes continuous (Hill). Whoever has to deal with cranial injuries is familiar with the flow of cerebrospinal fluid from the nostrils or ears after a fracture of the base of the skull, sometimes even to the amount of several liters a day, as in a case of basal fracture recently under my care at the Episcopal Hospital. Comparatively large quantities of cerebrospinal fluid have also been known to drip spontaneously from the nose as in the cases reported by Halliburton, Hill, and others; and the rapid reaccumulation of fluid after evacuation in cases of tumors and other lesions goes further to prove that the cerebrospinal fluid is being constantly poured into the cerebrospinal

<sup>1</sup> *Archiv f. klin. Chir.*, 1912, xeviii, p. 826.

cavity. I<sup>1</sup> had an opportunity, in a case of tumor, to tap the ventricles through an opening in the skull on several occasions, when I withdrew from 60 to 150 c.c. of cerebrospinal fluid, from two to five times the normal content of the ventricles, only to find the fluid replaced within the space of twenty minutes.

It has been suggested that the secretion of cerebrospinal fluid may be controlled by ligation of the common carotid arteries, and in fact this operation has been recommended in the treatment of hydrocephalus. Inasmuch as the clinical observations are very limited in number, we<sup>2</sup> have been carrying on a series of experiments to determine the effect of disturbance of the cerebral circulation upon the rate of secretion in order, if the results were confirmatory, to place the operation on a sounder basis. We were able to obtain readings of the normal flow of cerebrospinal fluid and, with these as controls, observed the effect of various circulatory disturbances, clamping first one, then both common carotids; one and both internal jugular veins. Curiously enough, this interference with the larger vessels of the cerebral circulation had absolutely no retarding influence on the rate of secretion.

I had an opportunity of making similar observations on two cases of brain tumor with hydrocephalus, and obtained essentially the same results. In one case an exploratory craniotomy was performed, but the tumor proved to be inoperable. The enormously distended ventricles elevated the osteoplastic flap sufficiently to make it possible to introduce the cannula through the scalp directly into the ventricles. The latter were tapped on several occasions; the cerebrospinal pressure was recorded before and after the withdrawal of measured amounts of fluid, and the time taken for the ventricles to refill was noted. Similar observations on the cerebrospinal pressure were made, both before and after ligation, first of one and then of both common carotid arteries. No definite change, either in the cerebrospinal pressure or in the time taken for the ventricles to refill, took place. Hence, it is evident, from the experimental data and from the clinical observations, that the function of the choroid gland cannot be controlled by ligation as that of the thyroid is. Therefore, ligation of the common carotid arteries should not be expected to influence favorably the hydrocephalus, either of congenital origin or the accompaniment of brain tumors, and this operation should not be endorsed, at least until contradictory evidence is forthcoming from other sources.

**Rate and Mode of Absorption.** From the clinical and physiological data which we now have at our command, there seems to be little doubt that the cerebrospinal fluid is being constantly secreted, and if this is the case, it must also be constantly escaping. While a great deal of research has been done to ascertain the exact mode of absorp-

<sup>1</sup> Journal of American Medical Association, 1914, vol. lxiii, No. 4.

<sup>2</sup> Frazier and Peet, loc. cit.

tion, there is still a difference of opinion. My experience, both clinical and experimental, has led me to believe that the absorption of cerebrospinal fluid is *largely by the venous channels*, lymphatic absorption being roundabout, slow and relatively diminutive.

By the injection of various dyes into the subarachnoid space, we<sup>1</sup> have been able to demonstrate positively that the lymphatic system plays a very insignificant part in the problem of absorption of the cerebrospinal fluid. We traced the avenue of absorption through the nerve-sheaths, chiefly of the olfactory and optic nerves, thence to the posterior part of the eyeball, and to the mucous membrane of the turbinates and septum, to the posterior lymph nodes of the nasopharynx, to the parotid and deeper cervical chain and thence to the thoracic duct. Usually, it took twelve hours for the stain to reach the lower glands.

A better method of studying absorption we found in the use of phenol-sulphonephthalein (an observation confirmed by the work of Dandy and Blackfan<sup>2</sup>) which, when injected into the ventricles, appears in the torcular Herophili in two minutes and in the urine in five minutes. As it takes almost twelve hours for the stained fluid to reach the cervical lymph nodes and only two minutes for it to appear in the veins, one sees that the cerebrospinal fluid is absorbed chiefly by the blood-channels.

Our study of the process of absorption has been greatly facilitated through the production of an artificial hydrocephalus. When phenol-sulphonephthalein is injected into a blocked ventricle, practically no absorption takes place, even after two hours there appears only the slightest trace and this is not constant, whereas in the unobstructed ventricle 60 per cent. of the drug is recovered from the urine in two hours. Hence it is fair to assume that an equal quantity of cerebrospinal fluid may be absorbed in the same time.

By this method, it is possible to differentiate the types of hydrocephalus, those with obstruction and those without obstruction of the ventricles. In fact, Dandy and Blackfan<sup>3</sup> have already applied it clinically with satisfactory results, and I have had an opportunity of testing several cases in this manner.

If we grant that absorption is chiefly *via* the venous channels, obstruction to the venous outflow will inevitably be followed by a rise in venous pressure, by the accumulation of cerebrospinal fluid and a resulting increase in intracranial tension. Herein lies the explanation of the accumulations of cerebrospinal fluid which we so often find associated with brain tumors, particularly of the posterior fossa where

<sup>1</sup> Frazier and Peet, American Journal of Physiology, 1914, vol. xxxv, No. 3. and Journal of American Medical Association, 1914, vol. lxiii, No. 4.

<sup>2</sup> Journal of American Medical Association, 1913, vol. lxi, No. 25.

<sup>3</sup> American Journal of Diseases of Children, 1914, viii, No. 6.

there is no obstruction at the foramen, since the greater part of the venous circulation leaves the brain through the jugular foramen in the posterior fossa. It is not necessarily the obstruction of the ventricles that causes their distention, but rather the interference with the absorption that follows when the passage of the cerebrospinal fluid from the posterior fossa to the cerebral cortex is obstructed because the isthmus of the tentorium is blocked. Furthermore, the improvement which follows puncture of the corpus callosum, permitting the escape of cerebrospinal fluid directly from the dilated ventricle to the cerebral cortex, may be due to the greater facility with which the fluid may reach the subarachnoid space.

Although some, notably Flatau and Cathelin, still claim that the lymphatics play the larger part in the absorptive process, the majority of writers are agreed that the cerebrospinal fluid escapes chiefly through the venous circulation. We are still in doubt, however, as to the mode by which it reaches the venous circulation. The experiments of Leonard Hill<sup>1</sup> have shown that the venous sinuses of the dura mater provide the principal outlet for the cerebrospinal fluid, and Cushing, agreeing with Adamkiewicz that there is a free communication between the subarachnoid space and the longitudinal sinus, believes that the latter is the main avenue of escape. The exact part played by the Pacchionian bodies is still a matter of conjecture. Although the experiments of Böhm, Schwalbe, and Key and Retzius, indicate that these small granulations offer the principal means of approach for the cerebrospinal fluid to the general circulation, I think this is doubtful, first, because, the Pacchionian bodies are not present in the very young or in lower animals, and secondly, because, as is so clearly brought out by the experiments of Dandy and Blackfan,<sup>2</sup> absorption is a diffuse process, taking place from the entire subarachnoid space, and is not restricted to any particular position of this space. In this connection, mention should be made of some experiments by Weed,<sup>3</sup> who concludes that the return of the cerebrospinal fluid to the general circulation is a process of filtration through the arachnoidal villi into the great sinus, the arachnoidal villi being the precursors of the Pacchionian bodies. According to the work of Dandy and Blackfan, absorption of the cerebrospinal fluid is directly into the capillary network of the entire subarachnoid space, spinal as well as cerebral. Mott, it will be remembered, on the strength of his canalicular theory, suggested that the cerebrospinal fluid might reach the venous blood by way of the capillaries.

**Control of the Production of Cerebrospinal Fluid.** In a further investigation we<sup>4</sup> made an attempt to determine the factors which might

<sup>1</sup> Loc. cit.

<sup>2</sup> Loc. cit.

<sup>3</sup> Loc. cit.

<sup>4</sup> Frazier and Peet: *American Journal of Physiology*, March, 1915.

influence the production of cerebrospinal fluid. Saline extracts of certain glands including the pancreas, spleen, kidney, testes, ovary, thymus, adrenals, liver, choroid plexus and brain were employed, but all of these caused a greater or less fall in blood-pressure, and, coincident with this a marked increase in the rate of flow of cerebrospinal fluid in proportion to the quantity of extract injected. This increase in the secretory output must be the result either of direct stimulation of the choroid gland or of the disturbance in blood-pressure. The fall of arterial pressure causes an increase in pressure and dilatation of the cerebral sinuses, which in turn force the cerebrospinal fluid out of the ventricles. Further observations tended to confirm the latter theory. *Thyroid extract alone* we found to have a specific *inhibitory action on the choroid gland*. Even when such small doses as to cause little, if any, change in blood-pressure were injected, the diminution in the rate of choroid secretion was marked. Hence, thyroid extract, independent of blood-pressure, causes a hyposecretion of the choroid plexus. We will refer later to the clinical application of this principle.

**Function of Cerebrospinal Fluid.** While the research of the last fifty years has made us familiar with the physical characteristics of the cerebrospinal fluid in health and their variation in disease, it has left us still in the dark regarding the precise functions of this altogether unique liquid which is analogous neither to lymph nor to the contents of the various serous cavities of the body.

The cerebrospinal fluid passing from the ventricles to the subarachnoid space, fills up all the crevices not already occupied by nervous tissues or bloodvessels, and thus serves as a waterbed to protect the brain and spinal cord against shock and injury at every motion. The vessels of the brain have, as Mott<sup>1</sup> notes, comparatively thin walls, and the arteries relatively few muscular fibers and vasomotor nerves. Hence, "the uniform pressure of the fluid sleeve which surrounds them supports the column of blood." However, apart from its purely mechanical role as protector to the brain and spinal cord against shock, we can but conjecture as to the real functions of the cerebrospinal fluid. But real and important functions it must have, else how are we to account for the grave sequelæ in cases in which its normal activities have been disturbed?

Some regard it as a means whereby the delicate balance of intracranial pressure is preserved. Inasmuch as the brain is practically incompressible, and the cranial cavity is completely filled by the brain with its blood supply and the cerebrospinal fluid, there must be a diminution in one of the latter upon each systolic contraction. We have already seen that intracranial pressure varies directly with the venous pressure; hence we have the raising and lowering intracranial

<sup>1</sup> System of Medicine: Allbutt and Rolleston, vol. vii, p. 269.

tension—the flux and reflux of the movements of inspiration and expiration, the cerebrospinal fluid serving as a most delicate self-adjusting mechanism to equalize and distribute pressure throughout the entire intracranial and intraspinal cavities.

Mott<sup>1</sup> believes that the cerebrospinal fluid, acting as a lymph for the central nervous system, plays a part in the nutrition of the brain, giving up carbon dioxide and water to the blood and receiving from the latter salts and sugar. Indeed, we all agree that there must be some means of exchange of products between the blood and the brain—some method of bringing nourishment to the nerve-cells and of getting rid of the by-products of their metabolism. Since it has been proved conclusively that there is no lymph in this part of the body, what is the “ambient medium?” Owing to the fact that the anatomical studies of Key and Retzius and Mott, and the staining experiments of Goldmann,<sup>2</sup> Quincke and others, have shown that the perivascular sheaths are continuous with the pericellar and perineural spaces, on the one hand, and the subarachnoid space on the other, it seems logical to believe that the cerebrospinal fluid may be the medium of exchange between the blood in the capillaries and the nervous tissues, the cerebrospinal fluid reaching the brain cells by means of the perivascular lymphatics. There are many pieces of research to prove that substances injected into the cerebrospinal fluid act directly and much more rapidly upon the brain cells than substances injected subcutaneously or intravenously. Jacob found that a dye injected into the cerebrospinal fluid may be seen in the brain a few days later, and Behring’s experiments with tetanus toxins show that the intravenous injection of the toxin was followed by no ill-effects, while death followed injection into the subarachnoid space. Logical as this theory, as to the proper interchange of products between the blood and nerve cells may sound, we cannot prove it absolutely, inasmuch as we have as yet no means of ascertaining the contents of the fluid as it is secreted by the choroid plexus, and comparing it with the fluid as withdrawn upon lumbar puncture. Mott is still experimenting along these lines. Moreover, there are some, notably His and Sicard, who would lead us to question the anatomical basis of Mott’s hypothesis, since they believe that the true lymph channels of the brain are separate from the perivascular sheaths of Robin.<sup>3</sup>

Dixon and Halliburton<sup>4</sup> believe that the cerebrospinal fluid serves as a means of eliminating carbon dioxide from the brain. Their recent experiments are of especial interest. Finding that the intravenous injection of brain extract and, more particularly, extract of the choroid gland, caused a decided hypersecretion of cerebrospinal fluid, they attributed this fact to the specific action of some substance, possibly

<sup>1</sup> *Lancet*, July 2 and 9, 1910.

<sup>2</sup> *Ibid.*, July 12, 1913.

<sup>3</sup> *Ferrier*, *Lancet*, October 18, 1913.

<sup>4</sup> *Journal of Physiology*, 1913, vol. xlvii.

a hormone product of brain metabolism—upon the secretory cells of the choroid gland. The exact chemical nature of this hormone—the product of brain metabolism—must remain a matter of conjecture, for the time being at least. Dixon and Halliburton note that the cerebrospinal fluid contains a large amount of carbon dioxide, which we know acts as a poison to the nervous system and that an excess of this in the blood causes a hypersecretion of cerebrospinal fluid. It thus would seem natural and logical that the cerebrospinal fluid is a means of eliminating carbon dioxide from the central nervous system.

The researches of Cushing and Goetsch<sup>1</sup> have suggested still another function which may belong to the cerebrospinal fluid; namely, that it is a medium for bringing the active principles of the secretion of the hypophysis into contact with the tissues of the central nervous system. They have demonstrated pituitrin, the secretion of the pars nervosa or intermedia, in the cerebrospinal fluid withdrawn by lumbar puncture, and have found that injections of this fluid have the same effect as pituitrin itself. The pituitrin must enter the third ventricle through the infundibulum, and thus becomes a part of the cerebrospinal fluid. Just how important a function this is, will be revealed by further research on the pituitary body. If the pituitary and its secretions are as essential to metabolism as the results from the physiological laboratories for the past few years seem to indicate, then this ability of the cerebrospinal fluid to bring the secretory output of the hypophysis to the nerve cells during their metabolism, would be one of its principal functions.

The researches of Kafka,<sup>2</sup> Goldmann<sup>3</sup> and others, lead us to believe that the cerebrospinal fluid, together with the choroid plexus, may act the part of protector of the central nervous system against infection. They hold back from the blood certain material which would be harmful, and, according to Kafka, bacteria and ferments are created by the cerebrospinal fluid and allowed to pass to the central nervous system, protecting it against infection. Indeed, Goldmann's late experiments with vital staining have proved that the choroid plexus is a "limiting membrane." He injected 50 c.c. of a 1 per cent. solution of Trypan blue into the jugular vein of a rabbit, and found subsequently that while the plexus cells were colored, no nervous symptoms appeared before the animal was killed. On the other hand, when 0.5 c.c. of 0.5 per cent. solution was injected into the spinal canal, spasms occurred almost immediately, and the rabbit died within two or three hours. Thus, the choroid plexus has the power of preventing the penetration of toxic substances into the cerebrospinal fluid, which is thus enabled to conduct nourishment to the nerve cells and keep from them substances

<sup>1</sup> American Journal of Physiology, November 1, 1910, vol. xxvii.

<sup>2</sup> Ztschr. f. d. ges. Neurol. und Psychiat., 1913, xv, 482.

<sup>3</sup> Loc. cit.

which would be detrimental to their metabolism. My own experience corroborates these findings, and I cannot but feel that this is one of the most important functions of the cerebrospinal fluid.

If the cerebrospinal fluid is so essential to the proper activity of the nerve cells, it is certainly not strange that very grave sequelæ should result from the pathological conditions, whatever they may be, which cause disturbance in the secretion, absorption, and circulation of the cerebrospinal fluid. However, sound and logical as many of these theories regarding the cerebrospinal fluid may appear, we must, nevertheless, await the results of more extensive research along qualitative as well as quantitative lines before we can hope to prove beyond a doubt the truth of these hypotheses regarding the real functions of this fluid which is continually bathing the structures of the central nervous system.

**Congenital Hydrocephalus.** Congenital hydrocephalus is one of the most serious and, at the same time, one of the most hopeless problems in the entire field of brain surgery. The abnormal accumulation of fluid may be in the ventricles (internal hydrocephalus) or it may be in the subarachnoid space (external hydrocephalus), but as the former is by far the more common variety, we will centre our attention upon it. The disease is usually progressive, the ventricles becoming so dilated that the brain is compressed to a thin layer, and the head grows constantly larger. If the child is not entirely lacking in mentality at birth, he soon shows signs of retarded mental development, epilepsy and the like, caused by the extreme pressure on the brain substance. (I need scarcely call to your mind the different physical defects, the protruding eyes, the gapping fontanelles, the small, withered face, the opisthotonos, the impairment of function often present in both arms and legs.<sup>1</sup> The picture is one of the most distressing with which we are confronted.) While various methods of treatment have been applied, including lumbar puncture, ventricular puncture, drainage into the different tissues and cavities, and, more recently, puncture of the corpus callosum, they have been, possibly excepting the latter procedure, almost uniformly unsatisfactory, because so little has been known about the true nature of the disease and its causes.

It has been suggested that hydrocephalus may be due to traumatic or psychic disturbances during pregnancy, to toxic or infectious disease of the parents, such as alcoholism, tuberculosis or syphilis, and even that there may be a degenerative process of the capillaries in the ventricular wall (Weber). It is true that syphilis is often present,<sup>2</sup> but, in the light of our present knowledge, it seems hardly possible that it is directly responsible for the hydrocephalus, but rather that it has caused a lesion which brings about the abnormal accumulation of fluid.

<sup>1</sup> Kalischer, *Congenital Hydrocephalus*, *Handbuch der Neurol.*, 1912, Band. iii.

<sup>2</sup> Kalischer, *loc. cit.*, *Amenta, Pædiatria*, August, 1914, xxii, No. 8.

The exact relation between hydrocephalus and trauma is also a difficult question. While a fall or injury may accelerate the course of a hydrocephalus which has been more or less dormant since birth,<sup>1</sup> it seems scarcely plausible that it would be the exciting cause. These factors are merely the result of speculation and lack scientific basis.

Our recent investigations into the nature of the cerebrospinal fluid—its formation and absorption—have proved conclusively that a disturbance of the balance between formation and absorption is responsible for all abnormal accumulations of cerebrospinal fluid in the ventricles. We have found, moreover, that there are three possible ways in which this balance may be lost: (1) Hypersecretion of cerebrospinal fluid by the choroid plexus; (2) obstruction to the passage of the fluid from the ventricles to the subarachnoid space where it is absorbed; and (3) defective or delayed absorption. We have, therefore, three types of internal hydrocephalus depending upon the different etiologic factors. The problem is not an easy one, however, because the symptom-complex of one variety differs in no way from that of the others. For a differential diagnosis, we must depend absolutely for the present, at least, upon certain arbitrary tests which have been devised for the purpose.

**TEST FOR OBSTRUCTIVE TYPE.** It is possible to determine whether we are dealing with the obstructive type by injecting the phenolsulphonephthalein into the ventricles and later performing a lumbar puncture. If the phenolsulphonephthalein is recovered in the fluid withdrawn, it is evident that there is no obstruction to the flow of the fluid from the ventricles to the subarachnoid space.<sup>2</sup>

**TEST FOR NON-ABSORPTIVE OR DELAYED ABSORPTIVE TYPE.** By injecting the phenolsulphonephthalein into the ventricles and taking the time required for its total excretion from the subarachnoid space, it is possible to determine whether defective absorption is the responsible factor. Under normal conditions, 60 per cent. of the phenolsulphonephthalein should be recovered in the urine within two hours of its injection. If a longer period is required, we are safe in assuming that the absorption is defective.

Knöpfelmacher and Mautner<sup>3</sup> have devised another method for testing the absorption of the cerebrospinal fluid by injecting horse serum through a lumbar or ventricular puncture and timing its disappearance by testing the fluid every other day. They found that the time of absorption in cases of hydrocephalus, especially of the chronic type, was greatly prolonged. Ibrahim, some time ago, studied the retention of hexamethylen in cases of meningitis and hydrocephalus and

<sup>1</sup> Tetzner, *Monatsschr. f. Unfallheilk. u. Invalidenw.*, 1913, xx, No. 10.

<sup>2</sup> Dandy and Blackfan, *American Journal of Diseases of Children*, 1914, vol. viii, No. 6.

<sup>3</sup> *Monatsschr. f. Kinderheilk.*, 1913-14, vol. xii, p. 505.

found that absorption was almost invariably delayed, but Knöpfelmacher and Mantner felt that the conditions under which urotropin passed from the blood to the cerebrospinal fluid and then disappeared from the latter were still unknown and might be controlled by the principles of osmosis rather than of secretion and absorption, and for that reason they adopted horse serum in its place.

We have at present no test to determine whether we are dealing with the third variety—the hypersecretive type. However, if a hydrocephalus is present, and if we have proved by the above tests that there is neither obstruction nor defective absorption, we may safely conclude, by a process of elimination, that it is a case of abnormal secretion.

**TREATMENT.** The treatment of hydrocephalus resolves itself into a problem of restoring the lost balance, and the method to be adopted depends upon the type with which we are dealing—the cause of the lost balance.

*Type I.* Granting that the cerebrospinal fluid is the secretory product of the choroid plexus or the choroid gland, the excessive formation of the fluid must be due to a pathological condition of the gland, bringing about a hyperactivity of its cells, or possibly to a toxic substance in the fluid itself, and is to be controlled by the use of some substances which will have an inhibitory effect upon the cellular activity of the plexus. After a series of experiments (see p. 21) to find such a substance, we discovered that extract of the thyroid gland definitely inhibits secretion of the choroid plexus. This would seem to hold out a ray of hope at least, for this hitherto hopeless condition, and I have now under observation a series of cases of hydrocephalus in which the effects of thyroid feeding are being tried. The results thus far, though limited, have been gratifying in that the process has been checked, and signs of retrogression have been noted in several instances. We, however, shall have to await the results of its application over a longer period.

While hypertrophy and other pathological conditions of the choroid plexus have been revealed by autopsy (Ferrier, Kafka, *et al.*), we cannot draw any definite conclusions as to the frequency of hypertrophy as a factor in hypersecretion until the choroid plexus has been carefully examined in a large series of autopsies. If it can be proved that there is a definite etiologic relation between the two abnormal conditions, will the time come when such an operation as the removal of the choroid plexus, or a partial choroidectomy, will be feasible?

We must also await further investigations along qualitative, as well as quantitative, lines before we can eliminate the possibility that a toxic substance in the fluid itself may be responsible for the hyperactivity.

*Type II.* In this type of hydrocephalus, an obstruction, in the shape of a tumor, cyst, inflammatory process, or congenital malfor-

mation, has blocked the passage of the cerebrospinal fluid from the ventricles into the subarachnoid space where absorption takes place. Whenever possible, of course, the obstruction should be removed, thus giving free passage to the fluid. If this is not feasible, a new outlet must be formed from the ventricles to the subarachnoid space so that the cerebrospinal fluid may come in direct contact with the venous channels by which it is absorbed.

Puncture of the corpus callosum, as proposed by Anton and v. Bramann<sup>1</sup> is the most advantageous means of accomplishing this

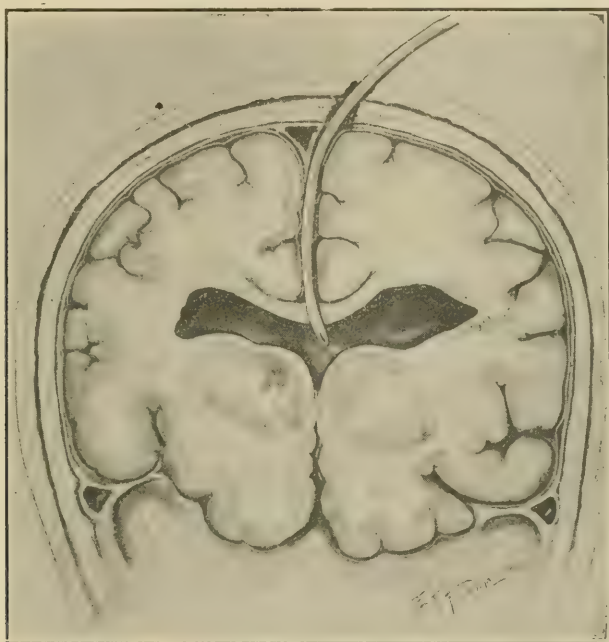


FIG. 3.—Horizontal section of brain with dilated ventricles secondary to brain tumor. The illustration depicts the introduction of the author's cannula through the corpus callosum into the lateral ventricle. (Anton's *Balkenstich*.)

purpose. The technique which I use, and which differs very little from that of Anton and v. Bramann, is briefly as follows: At a point  $1\frac{1}{2}$  to 2 cm. behind the coronary suture and  $1\frac{1}{2}$  to 2 cm. to the outer side of the median line, an opening is made in the skull with a Hudson burr, and a small slit made in the dura, care being taken not to injure the cortical veins. A curved cannula (see Fig. 3), which should be hollow and beak-shaped, is then introduced through this opening, passing between the brain and dura down to the falx cerebri, and fol-

<sup>1</sup> Die Behandlung der Gehirnkrankheiten mit Hilfe des Balkenstiches, Berlin, 1913.

lowing the falx down to the roof of the ventricle. The corpus callosum is then easily perforated, and the fluid should at once flow from the cannula. After the necessary amount of fluid has been withdrawn, the opening in the corpus callosum may be enlarged by gently moving the cannula backward and forward.

In the seventeen cases of hydrocephalus reported by Anton and v. Bramann<sup>1</sup> in which puncture of the corpus callosum has been practiced, the motor disturbances, consisting of weakness, spasticity and ataxic gait, were favorably influenced twelve times, and choked disk was markedly retarded in one instance. In several of their cases, stupor was less marked after the operation, and the reactions were prompter, and, in some, there was a distinct improvement in mental development. Ringel<sup>2</sup> has recently reported four cases of hydrocephalus treated in this manner, with considerable improvement in three, and no noticeable effect in one, and he advises puncture of the corpus callosum unreservedly in all cases of hydrocephalus, because it is a simple and safe procedure. In the five cases of hydrocephalus in which v. Rydigier<sup>3</sup> has applied puncture of the corpus callosum, one was permanently cured, while the others were improved to a greater or less degree. Archibald<sup>4</sup> has found that callosal puncture was only of slight temporary benefit in two cases. In one case, he performed a puncture first on one side, then on the other, and two months later he removed the right choroid plexus, believing that the hydrocephalus might be due to hypersecretion, but the child died of shock in 2½ hours.

Thus, the results of this treatment as applied to *congenital* hydrocephalus have not been especially brilliant in the past, but I think this is because it has been used indiscriminately in cases with, and cases without, obstruction. If the opening between the lateral ventricles and the spinal subarachnoid space is patulous, and the excessive accumulation of fluid is due to hypersecretion of the choroid plexus or to defective absorption, it is scarcely conceivable that establishing another opening to the subarachnoid space will have any appreciable effect upon allaying the hydrocephalus. Hence, we must carefully apply the test for obstruction, and use this measure only in those cases where the natural passageway has been blocked, not, as Anton and v. Bramann advocate, in all cases of hydrocephalus which defy internal treatment and have not been ameliorated by lumbar and ventricular puncture. And I have come to the conclusion that this type forms a very small percentage of the total number of cases of congenital hydrocephalus. Puncture of the corpus callosum will, therefore, find its greatest usefulness in cases of acquired hydrocephalus, especially those cases of tumors with increased cerebrospinal pressure.

<sup>1</sup> Loc. cit.

<sup>2</sup> Beitr. z. klin. Chir., 1914, vol. xcii.

<sup>3</sup> Deut. Ztschr. f. Chir., 1912, vol. cxvii, No. 3-4.

<sup>4</sup> Canada Medical Association Journal, iii, No. 6.

*Type III.* For the type in which absorption is delayed or defective, we are at somewhat of a loss regarding treatment, because we can still only surmise as to the causes of the faulty absorption. Since the cerebrospinal fluid is absorbed by the venous channels, it is quite possible that an obstruction to the venous circulation, such as thrombosis, might be responsible for the delayed absorption. Indeed, it has been shown that occlusion of the venous circulation causes an increase in cerebrospinal pressure, and Dandy and Blackfan<sup>1</sup> have succeeded in producing a low-grade hydrocephalus by ligation of the vena Galena magna. Again, it might be caused by obstruction along the avenue of approach to the venous circulation, but there is as yet no unanimity of opinion as to the way by which the fluid reaches the veins. Still another possibility lies in the character of the fluid itself. It may be that in these cases of non-absorption, the fluid contains a toxic material which prevents its absorption. If this were true, the best method of treatment would be the use of some substance to counteract this toxic effect.

However, until this supposition can be substantiated, the only means of treating this variety is by drainage of the fluid into other tissues or cavities. We are only too familiar with the disappointing results following the various methods of drainage whether it be into the subdural or epidural space, into the pleural or peritoneal cavity, into the subcutaneous tissues of the head or neck, or into the venous circulation.

These failures may be due in some instances to faulty technique, but in general I think the fault lies in the fact that we are still in the dark as to the exact cause of the defective absorption, and hence are still treating this type empirically. Whether the restricted absorption is due (1) to some toxic material in the fluid which prevents its absorption by all tissues, or (2) only by the venous channels, or (3) whether it is due to an abnormal condition of the agents—whatever we decide they are—which transport the fluid to the venous circulation is still a matter of conjecture. If the first supposition be true, this condition is to be overcome only by the use of some substance which will counteract the effect of the toxic material; if we take the second view, we must devise a means of draining the fluid into other tissues of the body; and if we adopt the third possibility, we must effect an artificial passage for the fluid into the venous circulation. Up to the present time, it has been impossible to demonstrate any definite toxic material in this type of hydrocephalus. Many attempts, however, have been made to drain the cerebrospinal fluid into other tissues, and have been described in previous numbers of *PROGRESSIVE MEDICINE*. Hudson<sup>2</sup> has conceived the idea of using the under surface of the subtemporal muscle for an additional absorptive area by introducing a silver wire

<sup>1</sup> Loc. cit.

<sup>2</sup> *Annals of Surgery*, 1913, lvii, No. 3.

drainage mat under the muscle. A curved incision,  $2\frac{1}{2}$  inches long, is made in the right subtemporal region down to the temporal muscle; the fibers of the muscle freed from the bone, and the wire mat introduced. Through an opening in the skull and dura, the ventricle is punctured, and a permanent drainage tube slipped over the puncturing tube and carefully rotated to its proper permanent location in the brain, the two lateral fixation wires being carefully preserved. The temporal muscle is then sewed over the mat and tube. In some way such as this it may be possible for us to achieve the results of a decompression and drainage at the same time.

Various authors (Nicoll, Ferguson, Cushing, and others) have advocated drainage of the spinal subarachnoid space into the peritoneal cavity, a procedure which of course can be of use only in those cases in which there is free communication between the cerebral and spinal subarachnoid spaces. It should be of especial value in those cases of hydrocephalus following the removal of a spina bifida. Cole<sup>1</sup> recently established drainage in a case of hydrocephalus accompanying spina bifida by utilizing the meningocele sac, the edges of which were everted and sutured into the lumbar muscles. Drainage was maintained for two weeks without leakage and the pressure symptoms were relieved, but the child died on the twenty-sixth day, from obstruction in the sac.

Heile<sup>2</sup> succeeded in draining the cerebrospinal fluid from the spinal canal into the abdominal cavity in a boy of eight with such a severe grade of hydrocephalus that it had caused spastic paralysis of the lower extremities, and he advocates this procedure in all cases in which the highest pressure is in the spinal canal. He had previously tried lumbar puncture and puncture of the corpus callosum with only transient benefit. The abdominal drainage was accomplished as follows: A diagonal incision was made from the level of the third lumbar vertebra to the edge of the pelvis in the triangle of Petit, and the spinous processes of the third and fourth lumbar vertebræ, removed. The abdominal cavity was then opened above the ilium in the triangle of Petit, and a rubber drain with a lumen of 0.4 mm. was implanted from the lumbar dural sac to the abdominal opening, passing between the external and internal oblique muscles. Five months after the operation, the contractures had entirely subsided, and the boy was learning to walk and able to get about alone. The x-ray, moreover, showed that the drain had healed in place without reaction. Heile does not believe that drainage from the cerebral subarachnoid space into the abdominal cavity, as proposed by Kausch, is feasible, but in a case where the greatest tension seemed to be in the fourth ventricle, Heile succeeded in establishing drainage from the cerebral subarachnoid

<sup>1</sup> Illinois Medical Journal, 1914, xxv, No. 5.

<sup>2</sup> Archiv f. klin. Chir., 1914, cv, No. 2.

space into the pleura by means of a rubber drain leading from the intradural space just behind the ear to the loose extrapleural connective tissue, the pleura itself not being opened. Two months after the operation the drain had healed in place, without reaction, and the choked disk, headache, and vertigo had entirely subsided.

The multiplicity of the procedures devised for drainage is sufficient evidence that we have as yet no entirely satisfactory method. Inasmuch as we have proved that the cerebrospinal fluid finally escapes by way of the venous circulation, it would seem that drainage of the fluid into the venous channels should be the most effective means of taking care of the excessive accumulation due to restricted absorption. But the results following attempts to establish a communication between the lateral ventricle and the longitudinal sinus (Payr and others) have been disappointing. And equally discouraging have been the results of Haynes' drainage of the cisterna magna into the longitudinal sinus. The problem, therefore, is far from solved. In view of the fact that our experiences have shown us that the lymphatics have a small part in absorption, I believe it may be possible to make use of these channels in cases where the normal absorption is disturbed, and I have already attempted, in one case, to establish drainage into the lymphatics of the neck by the use of strands of Handley silk. I am, however, skeptical as to the ultimate success of any method of drainage until we know more about the nature of this type of hydrocephalus and the cause of the faulty absorption.

I have not dwelt on the results of either lumbar or ventricular puncture, inasmuch as, in the light of our present knowledge, these are merely symptomatic and purely palliative measures. The time has come when we must attack the problem at its source—that is, influence the excessive formation of the fluid, create an artificial outlet in those cases in which the natural opening has become blocked, or remedy the defective absorption. Treatment must be instituted at once, when we have determined upon the type, for continued pressure means irreparable damage to the brain substance. If there is a choice as to the method of procedure, the simplest should always be chosen, since hydrocephalic children are always poor operative risks.

**Brain Tumors and Their Relation to Cerebrospinal Fluid.** That the cerebrospinal fluid has a most important part in the production of the clinical and pathological syndrome of brain tumors is a fact which can no longer be ignored. Indeed, the control of the excessive accumulations of cerebrospinal fluid, concomitant to so many of these tumors, is one of the most difficult factors in the entire problem of the treatment of brain tumors, and failure to recognize this fact is responsible, in part at least, for the somewhat disappointing results which have followed operative intervention.

While very high hopes were raised twenty years ago, as to the future of surgery in this field, our experience is showing that only a comparatively small percentage of brain tumors belong to the truly operable category; Ferrier places it as low as ten, while Bruns<sup>1</sup> believes that about 30 cases out of 100 are operable; on the basis of Oppenheim's statement that about 10 per cent. of his cases which have been operated upon are cured, Bruns draws the conclusion that 3 to 4 per cent. of the total number of brain tumor cases are permanently restored to health through surgical therapy; Küttner's<sup>2</sup> statistics are still less encouraging. Cushing<sup>3</sup> states that the percentage of complete recoveries can hardly be placed above 5; but that if one includes patients who have obtained freedom from discomforts, preservation of vision and prolongation of life, then the percentage of recoveries would rise to 50 or 60. Out of his last 100 consecutive operations for brain tumors, he had 7 operative deaths, and Pussep<sup>4</sup> reports 6 recoveries out of 11 radical operations. Tooth<sup>5</sup> has made a careful study of 500 cases of brain tumor at the National Hospital during the years 1902-1911, and has discovered that about one-half of this number resorted to operation.

I review these somewhat gloomy facts not at all for the purpose of inducing a pessimistic attitude toward the value of surgical therapy, but rather that we may see where the crux of the situation lies, and attack the problem in a different way. The small number of cases which have been found truly amenable to a radical operation and the low percentage of complete recoveries, are facts which we must attribute to the character of the organ in which the lesion develops and the nature of the lesion itself rather than to faulty diagnosis or defective technique. With the many contributions<sup>6</sup> which have recently been made to the anatomy and physiology of the brain, the localization of tumors in a comparatively early stage is now possible, excepting in those cases where the accompanying hydrocephalus has completely overshadowed or masked the tumor symptoms or so masked them that topographical diagnosis has been rendered impossible.

The principal requisites for success are early and accurate localization, accessibility, and the non-infiltrating character of the lesion. These points were emphasized anew by Horsley, MacEwen, and others, in the discussion on Brain Tumors at the International Congress of

<sup>1</sup> Trans. Internat. Cong. Med., Sect. on Surg., August, 1913.

<sup>2</sup> Journal of American Medical Association, 1914, lxiii, No. 18.

<sup>3</sup> International Congress of Medicine, 1913.

<sup>4</sup> Verhandl. d. XII Kong. russ. Chir., 1913.

<sup>5</sup> Transaction International Congress Medicine, Section on Surgery, August, 1913; and Proc. Roy. Society Med., Sec. on Neur., 1912, vi, 2.

<sup>6</sup> Monakow, Die Localisation in Grosshirn u. der abbau. der Funktion durch Kortikale Herde, Wiesbaden, 1914; Rothmann, Topography of the Cerebellum, Ber. klin. Wochschr., 1913, i, No. 8; Barany, Wien. klin. Wochschr., 1912, xxv, No. 52; Deut. med. Wochsch., 1913, xxxix, No. 14.

Medicine, in 1913. According to Horsley, the three classical signs, headache, vomiting and optic neuritis, are often end-results, and should never be allowed to appear before operation is recommended. MacEwen reported the removal of a large tumor in a case where the only signs were slight paresis of the right arm and contraction of the left pupil. Great stress was also laid upon the necessity of delicacy of manipulation, complete hemostasis, etc., by v. Eiselsberg, Bruns, and others, but we have dwelt on these points many times in the past.

On the other hand, there are cases—and our experience is showing that by far the larger number fall in this category—in which localization is impracticable until relief of pressure has rendered an accurate topographical diagnosis possible, or altogether impracticable on account of the nature or location of the growth. The extirpation of the infiltrating malignant variety is as difficult here as elsewhere without the removal of the entire organ, and, as pointed out in Ballance's<sup>1</sup> recent article, we cannot perform a hemicerebrectomy as we would a hysterectomy.

Thus, leaving out of consideration the small percentage of cases of brain tumors which can be located and are truly operable, the problem of the treatment of brain tumors resolves itself into two parts: (1) In cases of operable, but unlocalized, tumors, to remove the intracranial tension insofar as possible, so that the focal signs will become sufficiently pronounced to permit of accurate topographical diagnosis, and by removing the pressure, to render the conditions for a radical operation more favorable; (2) In cases of tumors which are inoperable either on account of their nature or their inaccessibility, to alleviate the suffering and prolong life by relieving the intracranial tension. While the latter procedure can be only palliative, it is of the utmost importance because the most distressing symptoms are usually not the result of such focal disturbances as may be caused by the tumor itself, but rather the papilledema, headache and vomiting which are the result of intracranial tension.

It is, therefore, a question of selecting the most advantageous means of removing the pressure; and not a moment should be lost, for, as v. Eiselsberg<sup>2</sup> says in his review of 168 operations for brain tumors, "early diagnosis and early operation are the great desiderata of cases of brain tumor. The fate of a patient, condemned as he is to horrible headache, and inevitable blindness, is so terrible, that operation should invariably be done, and that before irreparable damage to the eyes has occurred." And this is merely reiterating the views of Horsley and MacEwen, and the view which I have often expressed. Once the tumor is suspected, the main question is not *when* to operate, but *how*,

<sup>1</sup> Lancet, 1913, ii, p. 972.

<sup>2</sup> Archiv f. klin. Chir., 1913, ccii, No. 2.

and this, it seems to me, depends entirely upon what we consider to be the cause of the increased intracranial tension.

Until very recently, we have attributed to the new growth all those symptoms of brain tumor which are the result of increased intracranial tension, and have thus attempted to relieve the pressure by a decompressive operation with varying degrees of success. My experience in the operating room and in the laboratory, has led me to take the view that in most instances the increased tension is the result of the excessive accumulation of cerebrospinal fluid in the ventricles (see Fig. 4), in the basal cisternæ, or throughout the subarachnoid space. In a recent paper<sup>1</sup> I cited cases from my clinic to show that tumors of any dimensions, irrespective of their size, character, or seat, may exist without signs of increased intracranial tension, and in these cases no increase in cerebro-



FIG. 4.—An enormously distended lateral ventricle in an inoperable brain tumor forcing up the osteoplastic flap.

spinal fluid was found at operation. *Per contra*, the encroachment upon the intracranial space, sufficient to give rise to the clinical picture of increased tension in cases of brain tumors (or to such physical evidences of increased pressure as may be demonstrable upon the operating table), is almost invariably the result of excessive accumulation of cerebrospinal fluid. It does not seem to make any difference where the tumor may be situated, whether in the cortex, deeper in the substance of the hemisphere, or at the base, the increase in the amount of cerebrospinal fluid is the factor responsible for all but the focal symptoms. In sub-tentorial lesions, this phenomenon is even more constant.

Thus, we are once more confronted with the problem of controlling the output or the absorption of the cerebrospinal fluid, and the remarks

<sup>1</sup> New York Medical Journal, June 27, 1914.

under the treatment of hydrocephalus apply here in the same manner. We must direct our energies to inhibiting the secretion, making a new outlet, or facilitating absorption, and the same tests may be applied here to differentiate between the three types.

At first thought, it would seem that we were dealing with the obstructive type in most of these cases, but many tumors are so situated that they could not block the openings to the ventricles. On the other hand, it is possible, as shown by our experimental work (see p. 19), that we may have an obstruction, even in cases where the aqueduct of Sylvius and the foramen of Magendie are not actually blocked by the tumor, since the tumor may exert sufficient pressure to force the midbrain upward, thus blocking the isthmus of the tentorium cerebelli.

The extraordinary rapidity with which the cerebrospinal fluid reaccumulates after evacuation, is strongly suggestive of a hypersecretive type. I<sup>1</sup> had an opportunity, in a case of tumor, to tap the ventricles through an opening in the skull on several occasions, when I withdrew from 60 to 150 c.c. of cerebrospinal fluid, from two to five times the normal content of the ventricles, only to find the fluid replaced within the space of twenty minutes.

There is little doubt, too, that defective absorption plays a part in the abnormal pressure in these cases. Inasmuch as the fluid is absorbed chiefly by means of the venous circulation rather than by the lymphatics, retardation of absorption might be explained by pressure upon the venous trunks. If this were true, tumors of the base, because of their relation to the large basal sinuses, should be, as they are, more frequently attended with a secondary hydrocephalus than tumors of the cortex.

Many intracranial tumors grow at an amazingly slow pace, and thus, if the continued and increasing pressure of the associated hydrocephalus were effectively controlled, the prognosis of brain tumors would be less grave and the expectation of life prolonged. I believe, therefore, that the palliative treatment of brain tumors has become a problem of dealing with the excessive accumulation of cerebrospinal fluid, and the question arises: Shall temporal decompression as a palliative procedure be altogether supplanted by measures to take care of and prevent the abnormal accumulations of cerebrospinal fluid. Such procedures at once strike at the root of the trouble and not only relieve the pressure for the time being, but prevent its immediate recurrence.

Lumbar and ventricular puncture have been practiced for some time, but these give only temporary relief to the increased pressure, and it also must not be forgotten, as Church<sup>2</sup> has pointed out, that there is a certain amount of danger attached to lumbar puncture when the tumor is situated at the base of the brain, since too rapid removal of pressure at the lower end of the spine induces a fatal backward pressure of the

<sup>1</sup> *Journal of American Medical Association*, 1914, lxiii, p. 287.

<sup>2</sup> *Chicago Medical Recorder*, 1913, xxxv, 509.

medulla on the foramen magnum. Various drainage operations have been tried too, with only a slight degree of success.

The first procedure to strike at the root of the problem and to prove successful is puncture of the corpus callosum as proposed by Anton and v. Bramann, and there has been of late much discussion as to the relative merits of this operation and a temporal decompression. Anton and v. Bramann<sup>1</sup> advocate it in all cases of tumors and pseudotumors accompanied by internal hydrocephalus, and for the relief of pressure before extirpation of a brain tumor in cases where the brain is under great tension. Excluding tumors of the ventricles and the hypophysis, they have punctured the corpus callosum nine times for brain tumor. The papilledema was improved in 8 cases; headache was at least temporarily relieved in all; in 7, motor disturbances were favorably influenced; vomiting and dizziness were relieved seven times; and spasms twice.

Hessburg<sup>2</sup> is strongly in favor of puncture of the corpus callosum, and v. Hippel,<sup>3</sup> who was at first skeptical as to the value of this measure, is now a strong advocate except in cases where the optic nerves have become atrophied, and he believes that it should be given preference over other procedures to relieve pressure inasmuch as it is a simple and relatively safe operation, is performed under local anesthesia, and avoids the possibility of a prolapse of the brain. His opinion is based on a series of 36 cases, in practically all of which the general symptoms were helped to a greater or less degree, and in case they are not, another operation can be undertaken under more favorable circumstances. He recommends that it be given a trial before a radical operation is performed, particularly in cases of cerebellar tumors where the mortality is still so high. If it were possible to differentiate between the cases in which pressure is due to increase in cerebrospinal fluid and those in which it is due to increase in the brain substance itself, v. Hippel, Ringel,<sup>4</sup> and several others would be inclined to advocate a decompression in the latter cases, but such a distinction is impossible for the time being at least.

Since we are dealing here with the means of arresting symptoms due to increased *cerebrospinal* pressure, I will not dwell at length upon the principles of decompression, or the variations in technique which have recently been devised.<sup>5</sup> I cannot agree with those (Ballance, Church, Hessburg, *et al.*) who advocate decompression over the site of the tumor, nor with those who believe that papilledema is usually indicative at least as to the side on which the tumor is situated.

<sup>1</sup> Loc. cit.

<sup>2</sup> Med. Klinik, 1913, ix, No. 5.

<sup>3</sup> Arch. f. Oplith., 1913, lxxxvi, 170.

<sup>4</sup> Beitr. z. klin. Chir., 1914, xcii.

<sup>5</sup> Stoppato, Deut. Ztschr. f. Chir., 1913, cxxii, No. 3 and 4; Hudson, Annals of Surgery, 1912, lv, 744; McGuire, New York Medical Journal, 1912, cxvi, No. 25.

With regard to the relative merits of decompression and puncture of the corpus callosum, it is too soon to draw conclusions and, as a matter of fact, I see no cause for so doing, for there is no reason why both measures should not be resorted to in individual cases, when either alone does not afford adequate relief of tension. Theoretically, puncture of the corpus callosum where, as in most cases, there is an excessive amount of fluid in the ventricles, is of more enduring benefit, but there are no substantial records on which to base a comparative estimate, and I should at this time merely emphasize the advantage of resorting to both measures when either alone has not provided the expected relief.

It is never wise to wait for localization symptoms when the general diagnosis of tumor has been made. If the lesion can be located approximately and is believed to be operable, a radical operation is absolutely indicated. If removal is not feasible, measures should be adopted at once to allay the pressure symptoms, for, as Ballance<sup>1</sup> has so aptly put it, "The intracranial tension is the one point of the disease which is always vulnerable to surgical attack, and, whether localization diagnosis is possible, or not, decompression should be carried out without delay." It is important to remember, however, that it is not merely a case of giving outlet to the increase in cerebrospinal fluid or brain substance, but also of restoring the lost balance between secretion and absorption, the normal conditions of which may have been disturbed by the presence of the foreign body.

**Meningitis and other Intracranial Serous Inflammatory Processes.** In the treatment of the various inflammatory processes with their serous exudations occurring within the cranial cavity, the question of how to deal with the abnormal quantities of cerebrospinal fluid again looms up before us. There are two principal factors in the pathogenesis of all these conditions: First, the infection or inflammation, and, second, the increased intracranial tension, and no treatment can be wholly successful which disregards either factor. Whatever the source of the infection, or its effect upon the meninges or the brain itself, our findings on the operating table, in the physiological laboratory and at autopsy, have demonstrated conclusively that it causes an excessive accumulation of cerebrospinal fluid and resulting increase in intracranial tension. The process may be limited to one or all of the meninges—meningitis, pachymeningitis, leptomeningitis—or it may involve the brain or ependyma—encephalitis, choroiditis, ependymitis; it may be pyogenic (including a number of organisms, streptococci, staphylococci, pneumococci and others) or be more specific, as tuberculous, or luetic; it may be chronic or acute, circumscribed or diffuse in type, and the exudate may be serous or pus-containing, but the problem remains the same.

<sup>1</sup> British Medical Journal, 1912, i, 608.

We not only must combat the infection, but we must overcome the increased intracranial tension. It is true, of course, as Warrington<sup>1</sup> states, that "serous effusion within the skull, like that within the thorax, is merely the manifestations of some primary pathological process, but pressure within the cranial cavity is the proximate cause of many grave cerebral symptoms and requires relief, independently of its origin." Indeed, we are only too familiar with the alarming picture of intracranial pressure which finally asserts itself in these cases, and I feel certain that the fatal outcome is due to this increased pressure quite as often as to the specific action of the bacteria or whatever may be the cause of the inflammation. We must, therefore, give careful consideration to the adoption of measures to relieve tension.

While a case of serous effusion in the cranial cavity was described by Robert Whytt in 1768, and while tuberculous meningitis was recognized as such by Papavoine as early as 1830, no decided advances have been made in the treatment of these conditions up to the present day. The introduction of lumbar puncture by Quinke in 1891, and the publication of his papers on meningitis serosa in 1893 and 1897, are important landmarks in the history. Boenninghaus and Schultze have both analyzed large series of cases, and more recently we have the contributions of Merle, Connal, Kopetzky and Haynes, Reichmann, and others, but in spite of the careful clinical, chemical and pathological investigations, all methods of treatment thus far suggested have been in most instances unsuccessful.

**SUPPURATIVE MENINGITIS.** As to the etiology of suppurative meningitis, there is always a near or distant focus of infection. It may be an otitis media, a labyrinthitis or an infection of the nasal sinuses; again it may be as far away as the pelvis or appendix, and it is not unusual to find this condition with certain infectious diseases, such as influenza, pneumonia, and typhoid fever. According to Warrington, the toxins formed by the organism, but not the microorganisms themselves, stimulate the vessels of the meninges, brain or ependyma and choroid plexuses to the formation of excessive fluid. Often the *fluid withdrawn in the early stages of a purulent meningitis will be sterile*, and no changes will be found in the meninges at autopsy, although microorganisms of low virulence may have been present in the fluid and caused symptoms closely simulating those of the more advanced stages of meningitis. Warrington<sup>2</sup> emphasizes the importance of arresting the process during the serous stage.

**TUBERCULOUS MENINGITIS.** The problem presented to the physician and surgeon by tuberculous meningitis is appalling, when one considers that thousands are dying each year from this malady, and that only 18 cases have been reported as cured during the last twenty years.<sup>3</sup> We

<sup>1</sup> Quarterly Journal of Medicine, 1914, vii, No. 26.

<sup>2</sup> Loc. cit.

<sup>3</sup> Reichmann: Münch. med. Wochschr., 1913, lx, No. 26.

know that tuberculous processes elsewhere are often suppressed or completely cured by the activity of the tissue cells which they have invaded. Why should it be otherwise in the brain? Were not the serious effects of increased intracranial pressure to be reckoned with, the tuberculous process of the meninges might be favorably influenced by the natural processes of cellular activity. But in so many instances, and here lies the crux of the situation, tuberculosis of the cerebrospinal meninges owes its danger to the mechanical effects produced by the excessive pressure upon the medullary centres or the gray matter, not to its infective character.

SEROUS OR ASEPTIC MENINGITIS. Finally, there is a large group of cases in which no microorganisms or toxins are demonstrable in the fluid, and which have been somewhat promiscuously classed as *serous meningitis*, but to which Reichmann<sup>1</sup> has recently applied the more appropriate term of *aseptic meningitis*. The etiology of this variety is still very obscure. While in some cases the effusion can be attributed directly to a suppurative process in or near the brain (these, according to Warrington, however, would be classed as "serous" stages of an inflammatory process), in many cases we can but conjecture as to its origin. It may be the result of toxins of non-pyogenic origin, as, for example, in cases of meningitis due to alcoholism or lead poisoning (Warrington). Again, this same aseptic serous effusion may be consecutive to injury to the skull or concussion of the brain, and it may follow infectious diseases, insolation, chronic psychic irritation, or psychic trauma, as in a case reported by Nonne<sup>2</sup> which terminated fatally, autopsy revealing an internal hydrocephalus and granulations of the ependyma of all ventricles. Herein may lie the explanation of some of the symptoms, which we have previously described as neurasthenic, following both actual and psychic traumata. Serous meningitis often simulates tumor or pseudotumor, especially when cerebellar symptoms are present. Bregman and Krukowski<sup>3</sup> report a case and I have seen several in which all the symptoms pointed to the existence of a cerebellar tumor, the only suggestion of meningitis being a short remission in the severity of the disease. The autopsy revealed a meningo-encephalitis serosa diffusa chronica.

TREATMENT. The prime requisite to success in the treatment of all forms of serous effusions, according to Warrington, is the earliest possible arrest of the development of the inflammatory process after the changes in the copper-reducing power of the fluid and its diminished alkalinity have been recognized. He believes that meningism, serous meningitis, and purulent meningitis, are but *grades* in an inflammatory process, and the *termination of the process in the "serous" stage is the*

<sup>1</sup> Münch. med. Wochschr., 1913, lx, No. 25.

<sup>2</sup> Deutsch. Ztschr. f. Nervenhe., Band xxvii, S. 212.

<sup>3</sup> Monatsschr. f. Psych. u. Neurol., 1913, 33.

*all-important clinical fact.* If the intracranial tension could be effectively controlled while the process is still in this stage and before toxins or microorganisms have appeared in the fluid, the prognosis should be exceedingly good, and this would hold equally true for those cases of non-pyogenic origin. If, on the other hand, toxins or bacilli have already appeared, measures designed for the relief of intracranial pressure should nevertheless be resorted to, thus tiding over a critical situation and affording time for the operation of tissue activity *versus* the infective agency.

Lumbar puncture has been used for this purpose and resulted in improvement, and even complete cure, in a very small number of cases. Hultgen<sup>1</sup> has reported 4 cases of meningitis which were cured by lumbar puncture, and more recently Reichmann and Rauch<sup>2</sup> have reported 2 cases of tuberculous meningitis which were cured in the same way. The best results were obtained by allowing the cerebrospinal pressure to remain somewhat above normal throughout the sickness, inasmuch as the ease with which the bacilli pass into the blood varies according to the amount of oxygen in the blood.

In PROGRESSIVE MEDICINE for March, 1913, I described in detail an operation which had been carefully worked out by Kopetzky and Haynes for the drainage of the cisterna magna for meningitis. When this operation was first proposed, I could not arouse any great enthusiasm over it, although the elaboration of the principles involved in the operation were the outcome of a very splendid piece of research. During the past year, 18 cases<sup>3</sup> have been treated in this way, with 17 deaths and one recovery. Such a mortality is not an endorsement of the plan of treatment, for there might be at least one spontaneous recovery in 18 cases. I am in entire accord with the principles upon which this operation was founded, but I have never been sanguine of the feasibility of draining the subarachnoid space throughout. Hence the ineffectiveness of any drainage proposition. At the present writing, we must rely in acute cases upon repeated lumbar puncture as a means of relieving intracranial tension and upon lumbar puncture or temporal decompression for the subacute or essentially chronic forms. In the serous type of chronic meningitis, the conditions to be met are analogous almost to those of hydrocephalus. In the suppurative forms of meningitis, the prognosis must depend today, as it has for generations past, upon the type and virulence of the organism. Even the much vaunted remedy hexamethylenamin has failed to measure up to our expectations.

<sup>1</sup> American Journal of the Medical Sciences, vol. xxxix.

<sup>2</sup> Loc. cit.

<sup>3</sup> Wilson, Phys. and Surgeon, June, 1913; Pierce, Annals of Otology, Rhinology, and Laryngology, 1913, vol. xxii; Dench, Laryngoscope, 1913, vol. xxiii; Day, Laryngoscope, 1913, vol. xxiii.

I have been intensely interested in this so-called serous form of meningitis, or, as Reichmann chooses to call it, aseptic meningitis, not only from the standpoint of diagnosis and etiology, but from the standpoint of treatment. I have operated upon several cases in which a chronic serous meningitis had been mistaken for a tumor because of distinctly focal symptoms, and I have been interested in observing the clinical course after decompressive operations. The relief usually is striking, although the convalescence may be prolonged and attended with relapses. In one case particularly, there was marked fluctuation in the ambient fluid and the degree of tension until finally the process, whatever its nature, was entirely arrested and the patient fully recovered.

**Introduction of Remedial Agents into the Cerebral Cerebrospinal Fluid.** Our increasing familiarity with the nature and functions of the cerebrospinal fluid is paving the way for more effective methods of treating cerebral syphilis, sleeping sickness, tetanus, and similar conditions. While the introduction of salvarsanized serum into the spinal theca has been more or less efficacious in allaying the progress of spinal syphilis, it has been found to have very little effect upon the symptoms of cerebral syphilis. Therefore, measures have recently been adopted to bring the remedial agent into direct contact with the brain cells by introducing it into the cerebral subarachnoid space. There are several ways of accomplishing this: injection into the brain substance itself, into the cisternæ at the base of the brain, into the ventricles, or directly into the subarachnoid space.

Levaditi, Marie, and de Martel,<sup>1</sup> in December, 1913, reported to the Societe de Biologie 2 cases of general paralysis in which they had injected salvarsan into the cerebral subdural space with appreciable improvement in the 2 cases. About this time, Bucarest<sup>2</sup> advocated injections into the spinal and cerebral subarachnoid space for general paralysis, and Sicard and Reilly<sup>3</sup> have recently worked out an operation called *craniocentesis* for injections into the subarachnoid space and brain itself. Under local anesthesia, they make a small opening in the frontal region, on each side of the skull, with a simple Lannelongue perforator, and through this opening they inject 5 c.c. of the serum directly into the cortex to a depth of 1 cm. The procedure, they have found, is accompanied by no pain, followed by no clinical reaction, and can be repeated as often as seems desirable. One of their patients received three frontal cortical injections every four days without any untoward effects. Through repeated trials on the cadaver, they found that substances injected into the brain itself remained subcortical, becoming diffuse in a direction parallel to the surface, with no tendency to penetrate the interior. Beriel<sup>4</sup> has attempted to reach the sub-

<sup>1</sup> Quoted by Marinesco and Minea: *Revue Neurolog.* 1914, xxii, No. 5.      <sup>2</sup> *Ibid.*

<sup>3</sup> *Bulletins et Mémoires de la Soc. Med. des Hôpitaux de Paris*, December 25, 1913.

<sup>4</sup> *Neurologisches Centralbl.*, 1914.

arachnoid space by passing a hollow needle through the sphenoidal fissure, but there was an aggravation of the symptoms in both of his cases.

A slightly different method is advocated by Marinesco and Minea<sup>1</sup> who introduce the serum into the cerebral subarachnoid space through a bilateral puncture 8 cm. from the edge of the orbit, using the apparatus devised by Neisser-Polak for brain puncture, "by which the puncture can be made in less than a minute, and which makes a minimal opening." They have applied this treatment in 19 cases of general paralysis, and, while there was a slight improvement in the mental condition in a few patients, the majority were unimproved, and in 2 cases the operation was followed by epileptiform attacks, and in one by a monoplegia. Both the attacks and the monoplegia soon disappeared however.

Förster<sup>2</sup> has recently carried out some inoculation experiments in which he implanted fragments of brains of general paralytics into guinea-pigs and monkeys, and at the end of his report he suggests the possibility of "taking advantage of the well-known susceptibility of the spirochetes to the antibodies in the blood by bringing these bodies into direct contact with the cells of the brain through injection of the patient's own serum into the subdural space or the ventricle."

Ballance<sup>3</sup> chose the lateral ventricle as the most favorable avenue of approach; his technique was as follows: The patient was anesthetized, and the head placed as nearly vertical as possible. A trephine opening was made to the right of the middle line just in front of the bregma, the dura opened, and the inner surface of the right cerebral hemisphere gently drawn outward by means of a retractor bent at a right angle. (A cannula three inches long, with a lumen of 1 mm., and fitted with a stylet whose rounded end projects beyond the end of the cannula, was used for this operation.) At this juncture, the cannula was passed through the anterior part of the corpus callosum about a quarter of an inch to the right of the middle line until it penetrated the anterior cornu of the lateral ventricle. The stylet was then withdrawn, and cerebrospinal fluid escaped. A rubber tube attached to a graduated glass vessel was then fixed to the cannula and the infusion into the ventricle commenced, at first with normal saline solution and then with salvarsanized serum which varied in amount from 35 c.c. to 60 c.c. To introduce the serum required about twenty minutes, at the end of which time it was necessary only to remove the cannula and close the wound in the scalp. He has used this procedure five times with no ill effects—twice in two patients and one in a third—but it is too soon as yet to speak of the end results. He believes it

<sup>1</sup> Loc. cit.

<sup>2</sup> Münch. med. Wochschr., 1913, vol. lx, p. 2700.

<sup>3</sup> Lancet, May 30, 1914.

may be useful not only in syphilis, but in sleeping sickness, meningitis, epilepsy, tetanus, and such conditions. If the inflammatory process has in any way blocked the ventricles, it is obvious that introduction of the serum into the ventricles would not only be futile, but extremely harmful.

When the outlets to the ventricles are blocked, and it is desired to inject the serum into the subarachnoid space, some more exact method than that of cranial or orbital puncture should be adopted. I am in entire accord with Mr. Ballance when he says that "a trephine opening and an accurate operative method is the only way at present known of scientifically injecting remedies into the cranial cavity."

Marinesco and Minea<sup>1</sup> suggest introducing the serum by every possible route, such as the intravenous and the spinal and cerebral subarachnoid spaces, in cases of general paralysis.

**The Hypophysis.** Despite the fact that the entire group of ductless glands, and particularly the hypophysis cerebri or pituitary body, have of late been the object of extensive physiological research and clinical investigations, and despite the fact that, as the result of these very careful and painstaking studies, we have been able to assemble a considerable amount of information regarding the function of this small gland in health, and the expression of its perverted function in disease, there are nevertheless many problems which are partly or entirely unsolved. It is, therefore, incumbent upon us to review carefully and critically every new bit of scientific work on the subject, and every new case which is reported, that more light may be thrown in the dark places, and that we may have a clearer and more accurate conception of the relation of cause and effect as to the lesion and its clinical expression. In this way we shall finally come to know, without hesitation and long periods of investigation, how to proceed in each case of pituitary derangement, be the expression slight or grave. We shall be able to foretell earlier and still more accurately, it is hoped, the precise type and location of the lesion responsible for each syndrome of pituitary disorder or the particular portion of the gland whose function has become abnormal—whether it be hyperfunction or hypofunction.

In the years which have elapsed since we first entered the mazes of thyroid diseases—their etiology, clinical manifestations, and treatment—the disorders of this gland have fallen pretty generally into two categories—the one including those types caused by hyperactivity of the gland or hyperthyroidism, and the other those cases which were attributed to a diminished secretion or hypothyroidism. During the first years of intensive study of the pituitary body, there seemed to be such a striking analogy between the two glands, that types of pituitary

<sup>1</sup> Loc. cit.

disease were described corresponding to Graves' disease and myxedema—the result of hyper- and hypofunction of the hypophysis. It was soon found, however, that just as the thyroid gland sometimes in its pathological cycle passes from a state of hyperplasia to one of hypoplasia, so also the symptom-complex of hypopituitarism is frequently seen to be superimposed on the clinical picture attributed to hyperplasia of the hypophysis. So often do we find a combination of these two clinical types in cases of pituitary derangement, that we have come to apply the term “dyspituitarism” to this large group of cases. Furthermore, in the hypophysis we are dealing not only with a bilobed gland, but with a gland in which the two lobes are anatomically and physiologically quite different. While it happens, of course, that in certain cases both lobes have become atrophied or hypertrophied, it is also true that the process causing the hypertrophy may be confined to one lobe—most frequently the anterior—and may so compress the other lobe as to cause a diminution in its activity. When one considers that, under normal conditions, the functions of the two lobes are utterly different, it is easy to see how complications and difficulties arise when their activities are disturbed. The complexity of the picture and the difficulty of its interpretation are further increased by the fact that it is often impossible to differentiate between intra- and extra-sellar lesions. A hypophysial lesion will often give rise to many purely cerebral symptoms, and, on the other hand, extrasellar tumors, through constant pressure on the hypophysis, may give rise to any or all of the symptoms of glandular derangement. It is to be remembered, too, that the hypophysis is a link in the chain of internal secreting glands. The disorder may originate in the hypophysis and later involve other glands of the chain, as witnessed by the emaciation in certain cases of dyspituitarism of adrenal origin, or the pituitary derangement secondary to a lesion elsewhere in the chain.

However we look at it, the problem is not an easy one. The röntgenogram may be of service in helping us interpret the clinical signs, but it is a well known fact that in a hyperplasia which has caused marked glandular symptoms, the enlargement of the sella is scarcely demonstrable in the röntgenogram, and *vice versa*. Nevertheless, the x-ray findings are in many instances of great value in showing the direction of growth of the lesion, and thus helping us to choose the most advantageous method of approach, when surgical intervention seems justifiable.

The treatment of pituitary disorders is not yet far enough removed from infancy to permit us to speak dogmatically. It is only by carefully weighing the various physiological and clinical data that we can hope to get at the root of the question, and know in which cases to depend upon glandular feeding, in which to attempt removal of the tumor, and in which to be content with sellar decompression. In those cases in which

surgical intervention is indicated, there is still much difference of opinion as to the most favorable method of approach. There is still much that is contradictory in the records of competent observers, but I can see with each year very definite progress and I will be content to dwell only upon what I have gleaned from literature and from personal experience during the past twelve months.

**Anatomy.** The very inaccessible and sheltered position of the hypophysis speaks strongly for its importance in the human economy, and, I suppose, this provision of nature is responsible, at least in part, for the fact that it has escaped the scrutiny of investigators for so many years. But since the gland has come within the scope of the research workers' observation, rapid strides have been made in both its gross and histological anatomy. These have been carefully reviewed in Goetsch's<sup>1</sup> monograph on the pituitary, and we will mention here only those contributions which have been made during the past year. Dandy<sup>2</sup> has been recently investigating, by means of intravital staining, the origin, course and distribution of the nerve supply to the pituitary body—a study very similar to the one made on the blood supply by Dandy and Goetsch.<sup>3</sup> His conclusions are as follows: "The nerve supply to the pituitary body is from the carotid plexus of the sympathetic system. Numerous branches radiate to the stalk along the hypophysial vessels and are immediately lost to view in the substance of the anterior lobe. The nerve supply to the posterior lobe is very scant, in marked contrast to the extensive innervation of the anterior lobe. The pars intermedia receives its nerves from the stalk. There is a connection between the carotid sympathetic system and the oculo-motor and optic nerves." He states further, that "the absolute differentiation between secretory and vasomotor nerves is a matter of much dispute, and is impossible. The impression, however, from the character and course of the nerve fibers, their greatly increased number in the region of the hypophysis, and their disappearance at a distance from the hypophysis, the differences between the supply of the anterior and posterior lobes, the connection established with the other cranial nerves, lead us to regard them as secretory, in contradistinction to vasomotor, the existence of which in the cranial chamber has not been observed."

The interpretation of *x*-ray plates has not, as yet, been placed upon a scientific basis. The extreme enlargements of the sella are easy of interpretation, but the limitation of the normal sella has as yet by no means been defined with a view to throwing light upon this phase of the subject. Potts<sup>4</sup> has reviewed 29 *x*-ray plates which have been taken

<sup>1</sup> Quarterly Journal of Medicine, 1914, vol. vii, No. 26.

<sup>2</sup> American Journal of Anatomy, 1914, xv, No. 3, p. 333.

<sup>3</sup> Ibid., 1911, ix, 137.

<sup>4</sup> Journal of American Medical Association, 1913, lxi, 1188-1193.

under his direction during the past four years for the purpose of locating foreign bodies in the eye. The ages ranged between four and sixty. He found that the sella varied from 8 mm. antero-posteriorly to 13 mm., and from 6 mm. in depth to 10 mm., and he states that while measurements greater than these may not indicate a pathological condition, they should, nevertheless, be looked upon with suspicion. Furthermore, he notes that the sella turcica, in contradistinction to the frontal and sphenoidal sinuses, attains its full size at an early age—further evidence of the vital importance of this small organ to the development of the body.

**Physiology.** The functions of the pituitary body are still largely a matter of theory, for, despite the numerous investigations of late, the conclusions deduced from the various physiological, clinical and pathological observations are astonishingly different, the one from the other.

An interesting question has arisen as to whether there is a physiological connection between the hypophysis and the cerebrospinal fluid. Livon was the first to come to the conclusion that the secretion of the hypophysis passed through the hypophysial stalk into the ventricles, where it mingled with the cerebrospinal fluid. The results of Creutzfeldt's histological experiments would lead us to believe that a part of the secretion of the pituitary, instead of passing directly into the circulation, enters the brain and the third ventricle, and Herring's<sup>1</sup> histological investigations on the pituitary in 1908, indicate that the colloid in the posterior lobe passes through the latter to the ependymal lining of the third ventricle, and thence escapes into the cerebrospinal fluid. Indeed, he was able to trace out the exact path which the secretion followed in rabbits who had been previously thyroidectomized so that the amount of colloid was increased. The findings of Cushing and Goetsch<sup>2</sup> are very similar. Their experiments demonstrate the presence of a material in the cerebrospinal fluid, which has the same effect when injected into animals as extracts of the pars intermedia of the hypophysis, or, in their words: "This would seem to establish the theory that the hyaline bodies of the pars nervosa—regarded by Herring as products of secretion of the posterior lobe, a view supported on experimental grounds by ourselves—actually discharge, as their histological appearance suggests, into the third ventricle and represent the source of the active substance resembling pituitrin in the cerebrospinal fluid." Bauer<sup>3</sup> and Kramer<sup>4</sup> have both found that the injection of cerebrospinal fluid causes a lowering of blood pressure. Most of these experiments, however, have been carried out with pathological cerebrospinal fluid. During the past

<sup>1</sup> Journal Exper. Phys., 1908, i, 282.

<sup>2</sup> American Journal of Physicians, 1910-11, xxvii, 60-86.

<sup>3</sup> Diskussionsbemerkungen in Wissenschaftlicher Arztegesellschaft in Innsbruck, November 22, 1912.

<sup>4</sup> Journal of American Medical Association, 1911, vol. lvi, No. 4.

year Wassing<sup>1</sup> has tried the effect on animals of injections either of normal cerebrospinal fluid or of fluid obtained from animals in whom function of the hypophysis has been accelerated by a thyroidectomy, and has found that the presence of demonstrable amounts of active substance of the pars intermedia in the cerebrospinal fluid of rabbits could not be proved in this way. He feels, however, that this substance may be present in the fluid in infinitesimal amounts, or that its effect may be counteracted by that of other substances, and even though it cannot be demonstrated in the rabbit, it may be present in the cerebrospinal fluid in man, particularly if the secretory activity of the hypophysis has been increased by disease. If it can be proved conclusively that a substance from a portion of the hypophysis passes into the cerebrospinal fluid, this fact may help us to solve some of the problems connected with pathological conditions of the cerebrospinal fluid and to account for some of the symptoms accompanying pituitary derangement.

The vital importance of the hypophysis is still a subject of controversy. At the Société de Biologie de Paris, in 1913, Camus and Roussy<sup>2</sup> presented seven dogs upon whom a complete hypophysectomy had been performed from one to four months previous. The animals were in excellent condition, and there was up to that time a complete absence of any somatic signs, although it would remain for the autopsy to show whether or not the extirpation had been complete.

Several Italians, notably Austoni and Chiasserini, feeling that the results of experimental extirpation must necessarily be uncertain because of the trauma inflicted on the surrounding region and the possibility of remnants of the gland being left behind, advocate a study of the problem by means of artificial compression of the hypophysis. Austoni<sup>3</sup> has attempted, by creating an artificial tumor of the gland, to solve certain controversial points regarding the pathogenesis of the hypophysial syndrome, principally as to whether the symptoms are to be attributed to the compression of the gland itself or to pressure inflicted upon structures at the base of the brain. While most authorities agree that acromegaly is the result of a hyperplasia, probably limited to the anterior lobe, some attribute it to a diminution in secretion, such as might be caused by a new growth, and others, particularly Kon, to a lesion of a certain trophic centre, situated at the base of the brain. We must acknowledge uncertainty still, as to whether the dystrophy syndrome is caused by an atrophy of the pars intermedia, or compression of both the posterior lobe and the infundibulum, or the irritation of a trophic centre at the base of the brain. Unfortunately, we are unable to tell from his report whether Austoni has any solution of this problem to offer us. He very carefully describes his technique

<sup>1</sup> Wien. klin. Wochschr, 1913, vol. xxvi, No. 31, p. 1270.

<sup>2</sup> Compt. rend. Soc. de Biol., 1913, lxxiv, 1386-1388.

<sup>3</sup> Policlin. Roma, 1913, xx, p. 159.

which is similar to Paulesco's—except that the horseshoe-shaped flap on the right side of the head is turned upward instead of downward, so that the brain can more easily be raised and the hypophysis exposed without a second opening. He recommends this method of approach for operations on the human being, but there is little doubt in my mind that the anatomical difficulties to be encountered make the route prohibitive.

Chiasserini<sup>1</sup> has come to the following conclusions after studying the effects of experimental inflammatory lesions of the hypophysis and the surrounding region: (1) That an inoculation with tuberculous or sporotrichotic material into the hypophysis of the dog will produce a gradual destruction of the organ which will eventually result in the formation of a circumscribed or diffuse tumefaction derived from a non-specific inflammatory process. (2) That of the three parts of which the hypophysis is composed, the most easily destroyed is the pars anterior, while the pars intermedia appears to be somewhat more resistant and at times to react with the factors of hyperplasia. (3) The alteration or destruction of the hypophysis, particularly the anterior lobe, is accompanied by dystrophic conditions, which do not, however, correspond to the extent of the lesion. Furthermore, they are not able to exclude lesions of the parapituitary structures as possible causative factors. (4) Finally, that no other gland or organ supplies the needs of hypophysial insufficiency.

The administration of pituitary extract, both by ingestion and injection, has been carried on in a rather haphazard fashion, and the subject of pituitary feeding is upon anything but an intelligent basis. Fortunately, therefore, several very excellent pieces of work have been recently done along these lines, notably Iscovesco's<sup>2</sup> researches with lipoids of the anterior lobe. He injected this lipoid,  $\frac{1}{2}$  cg. per kg. body weight, hypodermatically into the loose cellular tissues in the necks of rabbits, with the following results: (1) Agitation, continual restlessness, and pugnacity; (2) increased renal secretion, with an increased output of urea, chlorides, and phosphates; (3) increase in appetite; (4) active acceleration in growth in young, but not in adults; (5) increased weight of adrenals, heart, and kidneys, but not of the genital organs in either sex. When a daily dose of 2 to 5 cg. is injected in man, there results a temporary acceleration of pulse, slight diuresis, increased appetite, and, in asthenic patients, marked increase in energy. The important point is the absence of genital changes. While it might be claimed that there might be other lipoids than Iscovesco's II Bd. which would give these changes, I am inclined to agree with Kidd<sup>3</sup> who says that "we can hardly believe that, after all these years of

<sup>1</sup> Policlin., 1913, xx, No. 11.

<sup>2</sup> Compt. Rendus Soc. de Biol., 1913-14, vol. lxxv, p. 450.

<sup>3</sup> Review of Neurol. and Psych., 1914, vol. xii, No. 3.

careful chemical, physiological, and therapeutic investigations, Iscovesco would have failed to isolate these genito-dystrophic or hypertrophic pituitary lipoids if they really had existed." This seems to me a most reliable method of investigation, and much less misleading than the removal of the gland or experimental feeding.

Wulzen<sup>1</sup> has carried out a series of feeding experiments covering a period of three months in two groups of eighteen chickens, by feeding each chick five days a week with fresh bovine anterior lobe. His conclusions are as follows: (1) That the growth of young fowl is retarded by the addition to the diet of fresh, unmodified anterior lobe of ox pituitary. This is shown both in body-weight and in length of the long bones. (2) Involution of the thymus accompanies this retardation and may bear a causal relation to it. (3) These effects are more marked in the males than in the females.

Behrenroth<sup>2</sup> found that the injection of pituitary extract in young rats (2 c.c. given subcutaneously every second day), if continued long enough, brought about a condition similar to hyperpituitarism, the animals exhibited apathy, loss of appetite, retarded development, loss of hair, and increase in blood pressure. He found, however, that the effect of intravenous and intramuscular injections on the human blood pressure was by no means uniform, there being no constant increase, no change in the rate of respiration, and no appreciable effect on the general condition.

In a series of experiments with intravenous injections of pituitrin in dogs, Beco and Plumier<sup>3</sup> noted a moderate advance of blood pressure, a slowing of the pulse and an arrest of the diuresis, without a true secondary polyuria. The increase in pressure was more marked when the tonicity of the vagus had been previously interrupted or the peripheral extremities of the nerve paralyzed; it depended on a visceral and peripheral constriction, the mechanism of which did not seem to comply with the action of the general vasomotor centre. The slowness of the pulse obtained by the administration of the pituitrin disappeared after vagotomy or paralysis of the terminal endings of the vagus with atropine, and the tachycardia, resulting from these two causes, disappeared under the influence of pituitrin. The arrest of the diuresis was dependent on a constriction of the renal vessels.

The intravenous injection of hypophysin in rabbits causes a peculiar transient respiratory disturbance, characterized by complete suspension of inspiration, and almost fruitless attempts at expiration and, in guinea-pigs, bronchial spasms and flatulence of the lungs. These respiratory disturbances, Fröhlich and Pick<sup>4</sup> attribute to irritation of

<sup>1</sup> American Journal of Physicians, May, 1914, xxxiv, No. 11.

<sup>2</sup> Deut. Arch. f. klin. Med., 1914, cxiii, Nos. 3 and 4.

<sup>3</sup> Bull. Acad. Roy. de Med. de Belg., 1913, xxvii, 369.

<sup>4</sup> Arch. f. exp. Path. u. Pharmacol., 1913, lxxiv, pp. 92, 107.

the vagus ending in the bronchial musculature, which may be prevented, as indicated by the experiments of Beco and Plumier, by the administration of atropin, but not by resection of the vagus.

The experiments of Kleemann<sup>1</sup> on the effect of extract of the hypophysis from animals that have been castrated or have had the corpora lutea removed, show that hypophysial extracts should not be made from animals that have recently been pregnant or that have been castrated, as the effect, especially on the bloodvessels, is not as constant as that from normal animals.

**Symptoms of Pituitary Derangement.** In addition to the knowledge we gain from experimental removal of the gland, from experimental stimulation or destruction from the outside after the gland has been exposed, and from glandular feeding experiments, we can learn much as to its functions in health and the perversion of these functions in disease by a careful clinical study of the manifestations of pituitary disorders in man.

The symptoms accompanying pathological conditions of the hypophysis are usually divided into three groups: (1) The local and general pressure symptoms; (2) glandular symptoms proper; and (3) polyglandular manifestations. Local pressure manifests itself in the form of severe bitemporal headaches, changes in the sella turcica, which are demonstrated in the röntgenogram, and disturbance of the optic nerves—optic atrophy, choked disk, and, most characteristic of all, complete bilateral hemianopsia, and occasionally photophobia. The symptoms of general pressure are similar to those of brain tumors accompanied by increased intracranial tension, namely, headache, choked disk and optic atrophy, and occasionally vomiting. Pressure symptoms often overshadow the other manifestations of disorder when there is an extreme enlargement of the gland or a large extrasellar tumor, and may or may not be accompanied by signs of hyper- or hypopituitarism. With glandular symptoms present, the clinical picture is not always easy of interpretation. As I have said before, in human pathology we are dealing most frequently with the complex pictures of *dyspituitarism*, since there are few cases of pure *hypo-* or pure *hyperpituitarism*.

Many complexities arise from the fact that not infrequently symptoms of glandular insufficiency follow close on those of hyperactivity. Moreover, the disturbance of function may be confined to one lobe, or there may be hyperactivity in one lobe simultaneous with insufficiency in the other. Thus, it is not strange that we are still unable to forecast correctly the exact nature and location of the lesion.

The hypophysis has very distinct and important functions in that chain of ductless glands which together control skeletal development,

<sup>1</sup> Arch. f. Gynäk., 1913, ci, 351.

metabolism, and sexual life. It is now pretty generally conceded that the anterior lobe has a profound influence over growth of the skeleton and cuticular tissues, while the posterior lobe and pars intermedia influence carbohydrate metabolism, and the contractility of muscular tissue, particularly of the heart, kidneys, and mammary glands.

That there is a definite relation between the hypophysis and the development of the genital organs is now generally accepted, but we are still uncertain as to just which portion of the gland is concerned. Peritz<sup>1</sup> who presents a most inviting theory, claims the pars posterior of the hypophysis and the sexual glands contain secretions which are mutually stimulative. Hence, atrophy of one of these will cause disturbance of the other, and inasmuch as the two lobes of the pituitary are chemically antagonistic, the balance between these two parts is at once lost. This explains quite readily the acromegalic symptoms often found in patients who present otherwise, signs of hyposcretion of the pars posterior, and Newrath's observation that "eunuchs owing to castration are very tall and present gigantic symptoms," further supports Peritz's theory. Attention has been called to Henri Iscovesco's (see p. 56) statement that no genital changes result in either sex from the use of lipid from the anterior lobe, and his findings were confirmed by those of Camus and Roussy, who showed that the genital atrophy and polyuria of the adiposo-genital syndrome were to be attributed not to a lesion of the pituitary body itself, but rather to a parapituitary lesion at the base of the brain, injuring certain paths intimately connected with the metabolism of the genital organs.

Cushing and Goetsch,<sup>2</sup> on the other hand, have come to the conclusion that pituitary extract, particularly that from the pars anterior, has a marked stimulating effect on the growth and development of reproductive glands in young rats of both sexes; that the extract of the pars anterior tends to cause early and frequent breeding, while the extract of the posterior lobe has no effect on the development or function of the genital organs. Furthermore, it has been found that extirpation of the anterior lobe of the hypophysis is followed in most instances by a hypoplasia of the genital organs in the adult, and by the continuance of sexual infantilism when the lobectomy has preceded adolescence. Barr,<sup>3</sup> in a discussion of the function of certain internal secreting glands, suggests that one should not attach too much importance to sexual defects as manifestations of acromegaly or dystrophy. It may be but an expression of that general law in genetics that all useless extremes and mutations, whether on the side of excess or of defect, bring with them the means of their own automatic extinction. Sterility is common to many incapacitating diseases; indeed, it is a well known biologic fact

<sup>1</sup> Hypophysenerkrankungen; Monatschr. f. Psychiat. u. Neurol., 1913, xxxiii, 404.

<sup>2</sup> Proc. Soc. Exper. Biol. and Med., 1914, xi, 26.

<sup>3</sup> Practitioner, April, 1914, vol. xcii, No. 4.

that the marked decline of any important organ tends not only toward individual, but even toward racial, death as well. We must, therefore, await the results of still further research and clinical observations before we can assert with any degree of certainty which portion of the gland is responsible for the genital atrophy which usually is such an important factor in both acromegaly and dystrophy. In fact, we cannot be certain that it is to be attributed to a pituitary lesion at all. Our experience has shown, however, that in certain cases, after the removal of a hypophysial tumor followed by glandular feeding, the sexual functions are reëstablished.

The following is a general scheme of classification of diseases of the hypophysis which has been compiled by Peritz<sup>1</sup> and which may serve as a working basis, at least for the present:

1. Diseases of the anterior lobe:
  - (a) Hypofunction—dwarfism.
  - (b) Hyperfunction—acromegaly, gigantism.
2. Diseases of the posterior lobe:
  - (a) Decreased function—hypophysial adiposity.
  - (b) Hyperfunction—diabetes insipidus.
3. Mixed forms (acromegaly and adiposity, dwarfism and adiposity).
4. Diseases of the hypophysis in combination with disease of the other glands:
  - (a) Genital glands and hypophysis—eunuchoidism.
  - (b) All glands—Claude and Cougerot's pluriglandular disease and Falta's multiple sclerosis.

While we are not yet in entire accord as to the causative lesion in acromegaly, the majority of investigators have given up Marie's theory of diminished activity and concur in the view first adopted by Fischer, Benda, and others, that a functional hyperplasia, probably of the pars anterior, is the etiologic factor in this condition. It may be a pure hypertrophy or an adenomatous hyperplasia, but usually not a destructive tumor or a hypoplasia except in those cases in which hyperfunction has passed into a state of hypofunction. Upon the various features in the symptom-complex of acromegaly, I have dwelt at length in the past<sup>2</sup> and will not review them here, but refer you to Leri's<sup>3</sup> excellent monograph on acromegaly. He emphasizes the importance of early x-ray studies, and brings out the principal points of difference between rachitis, myxedema, leontiasis ossea, Paget's disease, and acromegaly. He discusses also the various theories as to the pathogenesis of the disease, and concludes that it is due to a lesion of the pituitary body, but that it cannot yet be determined whether it is a hyper- or a hyposecretion. He further explains the fact that tumors of the hypophysis

<sup>1</sup> Loc. cit.

<sup>2</sup> See PROGRESSIVE MEDICINE, March, 1913, and March, 1914.

<sup>3</sup> Handb. d. Neurol., 1913, iv, 283.

occur without acromegaly on the ground that it has been proven experimentally that the functions of the gland are still in evidence even though but a portion of the gland remains.

Schlesinger<sup>1</sup> describes a special type of acromegaly developing very early in life and remaining stationary up to the age of fifty. The changes in the soft parts and in the contour of the skin and the genital disturbances correspond to the typical picture of acromegaly, the abnormal development of the extremities is sometimes, but not invariably, present, while the alterations in the sella and the ocular disturbances are completely lacking. Adenomata were found at autopsy in 3 cases, and in only one had the tumor attained considerable size.

Fröhlich's disease, or dystrophia adiposo-genitalis, has also been considered at length in the past. One of the best recent studies of this subject, by Artur Schüller<sup>2</sup> goes very fully into all phases of this condition, which he concludes is due to hypophysial insufficiency and is characterized primarily by the clinical triad of trophic disturbances—in the form of adiposity and genital hypoplasia, alterations in the contour of the sella, and the ocular disturbances (bitemporal hemianopsia). The skeletal changes, arrest of development, spontaneous fractures, and coxa vara, which Schüller says are a frequent accompaniment, I have not observed in any of my cases. The symptoms accompanying posterior lobe insufficiency—somnolence, slow pulse and respiration, subnormal temperature, low blood-pressure, and a tendency toward adiposity—Cushing and Goetsch<sup>3</sup> characterize as similar to conditions observed in hibernation. They examined the pituitary in a series of wood-chucks during hibernation and found it decidedly diminished in size.

While the symptoms accompanying insufficiency of the posterior lobe are pretty clearly outlined, the same cannot be said of those accompanying hyperplasia, except perhaps the frequent occurrence of diabetes insipidus. It is quite possible that just as obesity results from a hyposecretion of this lobe, so emaciation may accompany a hypersecretion. Experiments with posterior lobe extracts would seem to bear out this supposition. It is true that at any rate, that a certain percentage of dwarfed pituitary cases are very much under, rather than over weight. Falconer<sup>4</sup> has reported an interesting case of this character. The patient, a young woman, sixteen and a half years of age, suffered from diabetes insipidus, complete left homonymous hemianopsia, was under-developed, with complete genital infantilism, and very much emaciated. She was placed on whole gland pituitary tablets for a year, and gained decidedly in weight (from 3st. 4 pounds to 5st. 101 pounds),

<sup>1</sup> Wien. med. Wochschr., 1913, vol. lxiii, No. 39.

<sup>2</sup> Handbuch d. Neurol., 1913, iv, Spez. Neurol., 241.

<sup>3</sup> Proc. Soc. Exper. Biol. and Med., 1913, xi, 25.

<sup>4</sup> Edin. Med. Jour., 1914, xiii, No. 3.

her carbohydrate tolerance increasing at the same time. This undoubtedly was a case of deficient secretion of the pars anterior; the activity of the posterior lobe may have passed from a state of hyper- into a state of hypo-activity.

It has been recognized from the first, that mental disturbances—from listlessness and stupor to epilepsy and well marked insanity, may be part of the symptom-complex of pituitary disorders, but comparatively little effort has been made until recently to search for pituitary symptoms in cases of mental disorder. No one etiologic factor could be responsible for the various kinds of epilepsies and insanities, but it seems quite plausible that a derangement of the ductless glands may be responsible for some at least. Wenzel, indeed, many years ago, looked on colloid collections in the pituitary as the cause of epilepsy. A study of the autopsy findings at the Craig Colony for Epileptics, in New York, has recently been made by Munson and Shaw<sup>1</sup> who found occasional changes in the pituitary. It varied in weight between 0.281 gms. and 1.032 gms., the average being 0.541. None of the cases had presented clinical symptoms, and no large tumors were found, though in 3 cases there were large tumor-like structures, and in some cases the gland was much diminished in size. The records of 1600 consecutive autopsies (1879 to 1912) at the Massachusetts State Hospital for Insane at Danvers, have been recently reviewed by Bond.<sup>2</sup> He found a pituitary lesion in 45 cases—3 tumors with acromegaly, 3 tumors secondary to other foci, cysts, enlargements, etc. Out of 950 patients in the hospital in 1913, 10 exhibited symptoms of pituitary lesion. We cannot as yet draw any definite conclusions as to the relation between the hypophysis and mental derangements, but the circulatory disorders—the slow pulse, vasomotor stasis in the extremities, low blood-pressure and more or less adiposity—which accompany epilepsy, are at least suggestive of a certain relation. It will only be after a careful and systematic trial of the effects of glandular therapy in a large number of cases and a more extensive study of autopsy findings that we can hope to determine the exact relation.

**TREATMENT.** The treatment of pituitary disorders is neither altogether surgical nor altogether non-surgical. It is, of course, perfectly patent that there is no pharmaceutical preparation to be considered. Surgical therapy and glandular feeding, separately or in combination, are the only measures of known worth.

*Glandular Therapy.* It has been my practice to advise recourse to glandular feeding, when the patient is not subject to intense headaches, when loss of vision is not threatening, and when the röntgenogram does not suggest the presence of a new growth, as for example, by erosion of the posterior clinoid processes. The mere acquisition of fat or sexual

<sup>1</sup> Archives of Int. Med., September 15, 1914.

<sup>2</sup> Amer. Jour. Med. Sci., 1914, vol. cxlvii, No. 4, p. 575.

apathy, or some of the other metabolic disturbances do not make more radical measures imperative and hence justify a trial of glandular feeding. I have been using both thyroid and pituitary extracts, giving one or the other on alternate days in doses varying from 1 to 3 grains, three times a day. To be perfectly frank, I have seen but one case in which the treatment was so effective that the symptoms entirely disappeared. This case was in the practice of Dr. George E. deSchweinitz, who reported verbally to me that he had seen one other case in which the symptoms had subsided for a time only, and soon recurred. Thus the plan I have adopted has not as much support from clinical results as would seem to justify its endorsement, and yet, if there is no danger or risk in the postponement of operation, I see no reason why the patient should not have the benefit of the doubt, small as it is.

The subject of glandular feeding is one of absorbing interest, but as yet, no matter with what gland we may be dealing, thyroid, adrenal, or pituitary, we are but feeling our way along and standing only on empirical grounds. Theoretically, the anterior or posterior lobe may be given whenever the symptoms are at all definite and indicate insufficiency of one or the other of the two lobes, or extract of the whole gland when there is evidence of deficient secretion of both parts. On the other hand, when the clinical signs point to a hyperactivity, as for example, in cases of acromegaly, which is now attributed to a hypersecretion of the pars anterior, feeding with the anterior lobe would be not only futile, but contra-indicated. Only in the instance of hypofunction, when, from primary hypoplasia or pressure, the function of one or both lobes is more or less impaired, should we consider the propriety of prescribing glandular preparations.

*Surgical Therapy.* Granted the ineffectiveness or the impropriety of glandular therapy in a case in which the symptoms are progressive, blindness impending, what surgical measures come up for consideration? I think we can definitely discard temporal decompression as valueless as a palliative measure, and I think we can say without fear of contradiction that at the present time, a radical operation in the ordinary sense of the word, is beyond the range of possibility. I could conceive of cases in which from the increase of intracranial tension either as a result of the tumor itself, or because of an associated hydrocephalus, a temporal decompression would relieve some of the symptoms that are due alone to hypertension within the cranial chamber, chief among which are headache and vomiting. But as a matter of fact, in my hands, and so far as I can determine from the results of others, the operation has been singularly unsuccessful. In one instance, I began the treatment with a temporal decompression, merely to relieve an intolerable headache, but without appreciable effect, and later resorted to a sellar decompression which brought very decided relief. It is hardly to be expected that this operation will arrest visual disturbances and ultimate

blindness, and obviously it cannot influence the symptoms that are due to disturbance of the pituitary function.

In certain cases in which the hypophysial symptoms are accompanied by increased intracranial tension, it is possible that a puncture of the corpus callosum may alleviate the symptoms due to the concomitant hydrocephalus, though it naturally could have no effect upon the glandular disturbances, unless the latter were caused by pressure from the distended ventricles rather than a lesion of the gland itself. With this measure in pituitary disease, I have had no personal experience, but Anton and von Bramann,<sup>1</sup> in their recent monograph, report 5 cases with tumors of the hypophysis or in the hypophysial region, in which they attempted to relieve the symptoms by puncture of the corpus callosum. Widening of the lateral ventricles was demonstrable in all, and in 3 cases the pressure was relatively high. Headache and vomiting were favorably influenced in all 5 cases, and stupor in 4; in one case the papilledema, though worse immediately after the operation, soon completely disappeared. In still another case (Case 19) a year after the operation there was a recurrence of pressure symptoms which retrogressed, however, after a second puncture of the corpus callosum. These were all relatively far-advanced cases of long-standing. The autopsy findings, in 3 of the cases, revealed a tumor of the hypophysis which could not possibly have been removed on account of its infiltration into the third ventricle. Puncture of the corpus callosum, it seems to me, is a much more effective means of dealing with these advanced cases with a marked degree of intracranial tension, than temporal decompression.

The surgery of pituitary disorders today has resolved itself into relieving pressure on the pituitary itself, or on neighboring structures, by removing the floor of the sella turcica or by removing the tumor, or by both. For the present at least, I have fallen into the routine of practising first a sella decompression by the Hirsch technique (the endonasal approach with the submucous resection of the septum), removing as much tissue as presents in the opening, reserving for recurrences or failure to reach the lesion, dealing with it through the transfrontal approach. The immediate effects of sella decompression are gratifying. The operation is attended with a low mortality and by the relief of pressure, headache is alleviated and vision improved—sometimes within a few hours. Recourse to sella decompression at the first instance is a distinctly conservative practise, I admit, but I question whether in the absence of symptoms which threaten life, we should launch forth on a too radical course; furthermore, the comparative benignity of many of the so-called malignant tumors of the hypophysis, and the fact that in many instances we are dealing with a hyperplasia and not a neoplasm, may be offered as a further argument in favor of conservative practice.

<sup>1</sup> Loc. cit.

A sella decompression encourages the extension of the tumor toward the sphenoidal cells, rather than into the cranial chamber, as is brought out by Moritz<sup>1</sup> in his review of operations on the hypophysis cerebri, and pressure at the base of the brain is relieved. This may have some effect on the glandular symptoms, if we are to believe, as some of the recent research would seem to indicate, that certain of the signs are due to pressure at the base of the brain rather than disturbance in the gland itself. Cysts, of course, may be emptied and excised, and soft tumors of small dimensions may be scooped out, but the great majority of tumors are too extensive or inaccessible to be completely removed. Frequently, as emphasized by Hoffman,<sup>2</sup> the tumor is situated in the posterior part of the anterior lobe, so that there is great danger of removing with the tumor the normal tissue lying next to the sphenoid, as it is very difficult to differentiate macroscopically the normal from the pathological tissue. Most authorities are now agreed—and I am in hearty accord with this view—that we are scarcely justified in removing a portion of a hyperplastic gland simply for the relief of acromegalic symptoms, as it is too radical a procedure to be used except as a life-saving measure. And, moreover, it is not at all uncommon for a hyperplastic gland to undergo involution and become more or less inactive.

It must be remembered, however, that we are still in the developmental stage of pituitary surgery; we are feeling our way along cautiously and the opinions of today may not be those of tomorrow. A year ago, I was disposed to advocate the transfrontal approach to the sella turcica as the operation of choice in the majority of cases, and while I still believe this operation gives the best and the only intelligent approach to extrasellar lesions, it is often impossible to determine, beforehand, the exact origin or extent of the lesion. The size and deformation of the sella turcica itself is by no means as reliable a guide as one would suppose. In fact in some cases, with well marked symptoms of dyspituitarism, there is no structural change in the sella whatsoever. When there are clearly expressed extra-pituitary lesions, the presumption may be made that we are dealing with an extrasellar lesion—either a large tumor of the pituitary itself, extending well beyond the confines of the sella turcica, or a tumor originating in some extra-pituitary structure with pressure on the gland itself, as in a case in my series where the tumor took its origin from the optic nerve, but gave only symptoms of a true hypophysial hyperplasia.

With regard to the technique of the transphenoidal or the transfrontal operation, I have nothing to add to my commentary of a year ago. The latter operation is carried out without the slightest variation from the steps described in previous articles and in the former but few changes

<sup>1</sup> Brit. Journal of Surgery, 1913, i, 193-199.

<sup>2</sup> Ztschr. f. Ohrenk., 1913, lxix, 111-118.

have been made, although I am indebted to my assistant, Dr. L. H. Landon, for many refinements of technique. While we used to perform the operation in two sittings, we now do it in one; we used to resort to a general anesthetic routinely, now only exceptionally. We have found direct illumination of the greatest assistance after the sphenoidal sinus has been opened and the lesion is exposed. A small incandescent lamp is introduced into a carrier on a special cannula and gives a brilliant illumination of the field. We keep all patients in the hospital at least two weeks after the operation to avoid exposure to cold and infection of the upper air passages, after an unfortunate experience in which one of our patients, allowed to leave the hospital on the tenth day, developed at home an acute coryza, possibly of influenzal origin, and was returned to the hospital with signs of meningitis, from which he died. In that case, the temperature and pulse had been normal for more than a week, and the convalescence, up to the time the patient first left the hospital, entirely free from any untoward symptoms.

If, following the operation, the histological examination of the specimen removed suggests the need of glandular feeding with thyroid, anterior or posterior pituitary lobe, this treatment is at once instituted and continued as long as the patient continues to improve. Should there be any retrogression, the patient is advised to return for a second operation, in this instance, a transfrontal craniotomy.

**Cancer of the Face and Buccal Cavity.** **CANCER OF THE TONGUE.**  
*Etiology.* Cancer of the tongue hardly needs discussion. We have so often warned of the danger of chronic superficial glossitis, leukoplakia, papillomas, warts, chronic ulcers, fissures or irritable scars as to make them monotonous in the telling. Spencer<sup>1</sup> calls attention to the changes seen under the microscope in the early stages of cancer. At first the change is wholly in the epidermis; then there is an infiltration of small round-cells in the subepithelial connective tissue followed by a commencing down-growth of the epithelial columns but not so far as to invade the muscular substance of the tongue. Finally, a collection of small round-cells is seen in the lymphatic sinuses of the lymph nodes. Spencer calls particular attention to the importance of the subepithelial small-cell infiltration. He advises that the surgeon should be guided by immediate microscopic section, and the removal of sufficient tissue to include all the small-cell infiltration. If the microscope shows an epitheliomatous down-growth in the subepithelial tissue, the contents of the anterior triangle must be removed. When the epithelioma has invaded the muscular substance of the tongue and also the lymphatic glands, excision *en masse* or *en bloc* becomes necessary.

As for palliative treatment, he recommends painting with mercury

<sup>1</sup> British Medical Journal, 1914, ii, 457.

bicyanide 1 in 1000. He states that division of the lingual nerve is useless, application of the *x*-rays is futile because the gland develops the more rapidly, radium increases the pain, adrenalin causes sloughing, and diathermy requires a general anesthetic.

In the discussion of this paper, Child dissects out the glands of the neck first and attends to the tongue immediately after the gland dissection, because, if postponed for a fortnight, it is possible that in the interval cancer cells might be carried to the neck and there form the starting point of a recurrence. If it is necessary to divide the operation into two stages, he also performs the gland dissection first. When both sides of the neck require dissection, he begins on the more advanced side and endeavors to remove the tongue at this sitting; at the end of a fortnight or three weeks, he dissects the other side, but, in this, does not include removal of the internal jugular vein. In cases involving the frenum and floor of the mouth, necessitating division of the lower jaw, he operates in three stages; the dissection of the neck on one side, with ligation of the lingual, followed by dissection of the other side a fortnight later, and when this wound heals, division of the lower jaw in the midline and excision of the primary disease. Groves also referred to the advantage of division of the lower jaw as a preliminary of all extensive operations for the removal of the tongue. He divides the jaw by a > saw cut, the two portions of the > bevelled in opposite directions. This invariably permits union of the bone after wire suture.

He calls attention to the advantage of intratracheal insufflation anesthesia, but Dalziel objects to this as he prefers tracheotomy in order to deal with the floor of the mouth in the after-treatment by packing the operation area with gauze. Finally, Caird states that he generally employed novocaine as a local anesthetic and that he removed the tongue first in order to do away with the septic original focus. Ten days later, under general or local anesthesia, all the lymphatic structures of the tissue in the neck were removed *en bloc*.

Bloodgood<sup>1</sup> believes that he has apparently conquered the *technique of operations for cancer of the tongue*. "If we can educate men to come earlier, we shall probably conquer the disease." The operation he offers is based on the fact that the failure to cure, when cancer of the tongue is fully developed, is due chiefly to the neglect to remove the muscles of the floor of the mouth below the cancer, and the high mortality is chiefly due to removal of the floor of the mouth without removing a section of the lower jaw. He was first impressed with these facts when it was found that the first cured cases were either cases originating in the floor of the mouth, or cancers of the tongue invading the floor of the mouth, in which it was absolutely necessary

<sup>1</sup> Journal Iowa State Medical Society, 1914, iii, 848.

to resect portions of the lower jaw in order to remove the disease. He thus operates as follows: The glands of the neck are first removed, and, after the operation, their connection with the floor of the mouth below the lesion is thoroughly burned with the cautery, and the wound closed. Then the lesion in the tongue, or floor of the mouth is attacked with the electric cautery. The application of this is usually repeated two or more times, until everything is destroyed down to the area of the first cauterization from below. The healed skin flap of the first operation forms the floor of the mouth and prevents an oral fistula. Finally, removal of the section of lower jaw and cauterization area. Of the cases operated on by these newer methods (14 cases in all), there has been no postoperative mortality, and, so far, but one patient is dead of recurrent carcinoma.

I have read with considerable interest the paper by Trotter<sup>1</sup> on the *prognosis in cancer of the tongue*, because he offers several points which seem out of the ordinary. He first takes up the question of the apparent capriciousness of this cancer; cases in which a quickly fatal result is prophesied turn out favorably, and apparently favorable cases rapidly recur and extend; he refers to the experience, occurring in every surgeon's practice, of the patient who, after the primary growth has been successfully removed, has refused to submit to the gland dissection in spite of all warnings, and yet has remained permanently free from further trouble. "It cannot be supposed that cancer of the tongue is inherently capricious in a way that must remain incapable of analysis, or that between two apparently similar cases, one of which defies an extensive operation while the other yields to a comparatively trivial one, there is no real and discernible difference of type." Accordingly, he distinguishes a "superficial" and a "diffuse" stage of epithelioma. In the first, or early stage, the growth is strictly localized and unaccompanied by any infiltration of the tissues beyond its clearly palpable margin. The stage lasts, perhaps, for about three months on an average, and, if removed with a margin of palpably healthy tissue  $\frac{1}{2}$  to  $\frac{3}{4}$  inch wide, is practically certain not to recur. Trotter here observes, and I think rightly, that even the supposition that the growth is in the earliest stages has no bearing whatever on the question whether glandular infection has occurred or not. "It should be accepted as an incontestable principle in the surgery of epithelioma that as soon as the diagnosis of the primary tumor can be made, the presence of glandular infection must be assumed." The early stage may be manifested not only by the growth alone but by the growth and glands if both are hard, well-defined, and free from surrounding inflammatory manifestations. The high resistance of the body tissues rapidly destroys the outlying cancer cells and often the

<sup>1</sup> Lancet, 1914, ii, 989.

bulk of the tumor projects above the surrounding surface, hence the papillary and cauliflower growths are less malignant than the nodular or ulcerous forms.

Sooner or later, however, the tissue resistance breaks down, and the penetrating cancer cells spread into the tissues; this "late" stage is manifest by a loss of distinctness in the outline of the tumor, by an induration which fades gradually into the tongue. This diffuseness of outline may be very evident or only slightly marked, but the detection of it is always extremely important. A similar change occurs in the nodes; they become ill-defined and soft, so that they are not always distinctly palpable; later, they are apt to be accompanied by edema and diffuse brawny induration, possibly with redness of the skin. The nodular form is an admirable example of very early loss of tissue resistance.

When operations are undertaken for this type of disease, an extremely drastic procedure should be adopted. The ordinary forms of excision of the tongue without total removal of the affected muscles, including their origin, is a mere mutilation without any sufficient prospect of cure to justify it. Trotter calls attention to the sometimes diffuse growth in the tongue, although the surface may be quite intact and ulceration absent at a time when operative cure of the disease is almost hopeless. As a rule, the lymphatic resistance remains high throughout and no generalized lymphatic invasion occurs, but, when the tissue resistance breaks down, diffuse invasion occurs not only from the primary growth but from the glands. Consequently, the gland involvement should never be trifled with, and partial operations never done even in apparently very early cases.

Trotter states that the only serious dangers of even the most extensive operations are those due to sepsis, especially infection of the lungs and infection of the wound. They arise mostly from operations involving removal of the floor of the mouth. He regards preliminary laryngotomy or tracheotomy as the one essential precaution in diminishing the danger of lung infections after operations for cancer of the tongue; he considers it superior to intratracheal anesthetization. In regard to the local infection of the wound, he makes a most interesting observation. Edentulous patients without exception give rise to no serious anxiety on the score of sepsis. Ordinary cleansing of the mouth, scaling of the teeth, removal of stumps, use of antiseptic washes with brush and dental silk make very little difference to the risk when carried out as a preliminary to operation. Cleanly patients are little, if at all, less liable to serious complications than those who are careless and whose mouths are obviously septic.

Hence, Trotter believes that the possession of natural teeth by a man developing cancer in the mouth is a misfortune almost as great as the malignant disease itself. He urges the complete removal of

the teeth at least a month before operative procedures are begun, and does not believe that the lapse of a month will ever convert a curable growth into an incurable one.

The views of Crile<sup>1</sup> may be appended: "In operations for cancer of the tongue, two difficult problems must be met, the immediate surgical risk and the possibility of permanent cure. The principle immediate danger is pneumonia from inhalation of infection from the field of operation, while there is also danger from the exhaustion which is a result of the diminished ingestion of food and the prolonged endurance of the disease. To ensure a permanent cure, not only is the cancer to be removed, but all of the glands of the neck must be completely excised whether they be enlarged or not. If both of these operations be performed at the same seance, then the patient may die because he is unable to bear the burden of the diminished nutrition, the soreness over so large a field as the mouth and neck, and the inevitable infection in the mouth. The possibility of permanent cure depends also on the prevention of the immediate reimplantation of cancer cells in the mouth at the time of operation. If the cancer is not large, no cutting operation whatever is made, but, with the cautery, all of the disease in the mouth is destroyed. If, however, the growth be extensive, it is best on one day to cauterize the field of the disease and on the following day, after the diseased cells have died of starvation, to excise the entire cancer field in the mouth. After the patient has well recovered from the mouth operation and is able to take nourishment satisfactorily, the final operation—the excision of the glands of the neck—can be performed without great inconvenience to the patient. In addition to the lessened risk of the extension of the cancer, the two-stage operation lessens the danger of infection of the neck field also, for, when the whole operation is performed at one seance, the neck is so sore that the patient is almost certain to inhale more infection from the mouth directly; whereas if the neck be normal, the patient is able to stand up, to move about, to spit out inhalations, and thus to better protect the lungs against infection."

**CANCER OF THE LIP.** But little has been written on cancer of the lip recently and as a matter of fact but little need be written until the etiology of cancer is settled. A recognition of the precancerous lesions and their prompt treatment, the education of the laity to the futility of non-operative forms of treatment of cancer, a wide excision of the lesion and a thorough dissection of the neck would cure the great majority of cancers in this locality. But, instead, we have the fatal procrastination of the part of the physician, the vaunting of non-operative methods of treatment, the fear of the laity, to blame for the poor results of the present day. Bloodgood<sup>2</sup> shows that in the group

<sup>1</sup> *Annals of Surgery*, 1914, lx, 59.

<sup>2</sup> *Surgery, Gynecology, and Obstetrics*, 1914, xvii, 4.

in which the operation consisted of excision of the lesion in the lip and of the glands of the neck, but in which the glands showed no metastasis, the result in primary cases is a cure in 95 per cent. In the group in which the glands showed metastasis, the chance of cure was only 50 per cent.

Bloodgood's description of the treatment of the precancerous lesion of the lower lip is so complete that I am reporting it *in extenso*. The smoker must cease smoking; the individual who carries foreign material between his lips must discontinue the practice; the habit of biting the lower lip should be corrected, and ragged or protruding teeth filed or extracted. A mouth wash of sodium bicarbonate should be given, and if there is an ulcer it should be covered with a non-irritating ointment. He uses an emulsion of bismuth in castor oil, or a 2 per cent. yellow oxide of mercury ointment. In extensive ulceration, fever blisters, or chapping, he covers the ulcer with silver foil held in place by a little cotton fixed with collodion. If the lesion is small and does not heal in a week or ten days, it should be excised under local anesthesia. To avoid deformity, suturing must be very exact in these cases and the wound dressed with silver foil fixed with collodion. After further discussion of the methods of excision of the primary growth, Bloodgood states that he cuts the lesion out with the electric cautery, giving the palpable zone of induration at least 1 cm. of margin; then the burned area is cut out with the knife. In early cases he removes the local lesion and has it studied microscopically. If the disease proves to be a carcinoma, the gland operation is performed in a few days. In undoubted cases, complete operation is performed at once if the patient's condition permits; he insists upon a very complete dissection in the undoubted cases and follows the general plan pursued by most surgeons. He operates at any stage of the disease because every now and then one will accomplish cure in apparently desperate cases.

**EPITHELIOMA OF THE LIDS.** Most patients suffering from this affection consult the ophthalmologist, but sometimes they fall into the hands of the general surgeon. Fisher<sup>1</sup> reports 88 cases primary in the lids and canthi, or involving them from the skin in the immediate vicinity. The paper comes from the Mayo Clinic. These epitheliomas belong to the type known as basal cell, or, popularly, rodent ulcers. The average age of incidence was fifty-three years, but the youngest patient was only twenty-four years old. The lower lid (46 per cent.); the inner canthus (36 per cent.), the upper lid and the outer canthus were the points of origin. In 5 cases, cervical or parotid glandular involvement was present when the patient was first seen. They were treated chiefly in three ways, radical excision; excision with actual

<sup>1</sup> Journal of American Medical Association, 1914, lxiii, 751.

cautery of the wound; or simple actual cautery. The method depended on the site of the growth and the degree to which it had progressed. The plastic repair of the lower lid gave considerable trouble; many satisfactory results were obtained by the transplantation of a "hammock" flap of skin from the upper lid. (C. H. Mayo.) He thinks well of the operation recently described by Gibson.<sup>1</sup> Briefly, this method consists in the preliminary formation of a skin flap which can be transplanted later when the tumor is removed. The operation is completely described by Gibson, but, owing to lack of space, it suffices to state that an incision is carried outward a sufficient distance from the outer canthus; by means of a spatula, a pouch or pocket is formed, and into this is put a piece of skin which will adhere to the lower surface. Subsequently the inner and lower side of the pocket is cut and the flap pulled over into place.

In Fisher's cases no reference is made to final cure, but of 33 epitheliomas of the lids and canthi in which the records were completed by recent news of the patients, 94 per cent. were cured by operation. In another group involving the orbit, only 20 per cent. were permanently cured.

In the discussion of this paper, W. L. Clark stated that he had treated 49 epitheliomas of the lids and canthi by dessication surgery with a freedom from recurrence comparing favorably with the operative method. Fisher then states that he believes that the use of heat below the point of carbonization should be effective in all these lid or superficial cancers. He compares the results of radium treatment, as reported by Williams and Ellsworth,<sup>2</sup> where, in 13 cases, 68 per cent. were cured, as compared with 84 per cent. in Fisher's operated series.

**Tuberculous Cervical Lymphadenitis.** ETIOLOGY. Infection in children with the bovine tubercle bacillus has been the subject of frequent investigations in recent years. One of the best of these, and one especially applicable to the subject under discussion, is that by Mitchell.<sup>3</sup> He studied cases of tuberculosis in which the infection had taken place either through the nose or throat into the cervical lymph nodes or through the intestinal mucosa into the mesenteric nodes. We will discuss only the former. He investigated 80 consecutive cases of tuberculous cervical lymphadenitis and, of these, bovine bacillus was present in 71 instances (88 per cent.) and the human bacillus in 9 (12 per cent.). Without exception, the cases were those of children twelve years of age and under, and the maximum incidence was during the second year of life. Eighty-four per cent. of the children, two

<sup>1</sup> *Annals of Surgery*, 1914, lix, 958.

<sup>2</sup> *Journal of American Medical Association*, 1913, l, 1694.

<sup>3</sup> *British Medical Journal*, 1914, i, 125; and *Edinburgh Medical Journal*, 1914, N. S., xiii, 209.

years and under, had been fed with unsterilized cows' milk since birth. The patients were brought to the hospital on account of a lump in the neck, the average duration of which was  $7\frac{1}{2}$  months. It was also noted that in the large majority of cases the patients, apart from the glandular enlargement, were in robust health and showed no evidence of tuberculosis elsewhere in the body. In the bovine cases, Mitchell thought it seemed more than a coincidence that in not a single case was there a history of pulmonary tuberculosis in other members of the family. In 16 cases, however, one or more of the children in the respective families were affected with the various forms of surgical tuberculosis. In his first paper, he reports that in only three instances was a history of pulmonary tuberculosis found to occur in the patient's family. Each patient had been living for years in contact with a "consumptive" when the glands appeared. *In each of the 3 cases the human type of tubercle bacillus was isolated from the cervical glands.* As there was not a single case of pulmonary tuberculosis in the bovine series, Mitchell concludes that these children acquired the tuberculous disease from the infected milk supply.

Mitchell fails to find any reliable features which distinguish a lymphatic gland infected with the bovine type of bacillus from one infected with the human type. In his series the commonest site for the tuberculous lesion was in the upper part of the anterior triangle, involving the tonsillar and pharyngeal groups. He discusses the pathologic changes occurring in these nodes, but there is nothing new in this to report, except to remark that his cases were generally well advanced owing to the frequency of abscess, sinus, and infiltration of the sternomastoid muscle. He investigated the faucial tonsils in 64 consecutive cases of tuberculous nodes, and found that in 37.5 per cent. there was histologic evidence of tuberculosis in the tonsils. There are no clinical signs by which the condition can be recognized and the tonsil may be small or even receding. He also investigated the hypertrophied faucial tonsils removed from 90 children. In many, the cervical gland showed no evidence of tuberculous disease; 6 (6.5 per cent.) of these hypertrophied tonsils gave histologic evidence of tuberculous disease, while 9 (10 per cent.) yielded positive results when inoculated into guinea-pigs. The bovine bacillus was present in three instances, and the human in one case. In view of these findings he concluded that bovine tuberculosis can, therefore, no longer be considered a negligible factor in the spread of tuberculosis among children.

**OPERATIVE TREATMENT.** I have called attention to the treatment of this disease a number of times, and this year note four papers recommending operative treatment. The most interesting of these is by Neve,<sup>1</sup> who reports 800 cases operated upon in the Kashmir (India)

<sup>1</sup> British Medical Journal, 1914, ii, 813.

Mission Hospital. The climate of Kashmir is almost European, and the people are Aryans, but there are great differences in social conditions. The urban population is crowded, with much poverty, and no sanitation, but food is cheap and sunlight abundant. The cases reported included all the cases of excision and scooping-out during the past twenty years, but not the gland abscesses treated only by incision. There were 767 excisions, and about 40 eviscerations. They seem to do a thorough operation, and, in performing excision, remove all generally enlarged glands above the size of a bean or small marble, but do not attempt to try to remove all gland tissue in the neck for fear of chest infection. In regard to "evisceration," they state that the method is limited to some few very softened glands and that it may leave sinuses infected with tuberculosis. This is the method which I have condemned in previous years in discussing the operation of Dollinger and Treve. They use both the transverse and the long-curved incision, depending upon the extent of the lesion. They limit the time of operation to one hour, and do not operate on both sides of the neck at once if the disease is extensive. They have cut the spinal accessory nerve four times; and agree with our previous conclusion that section of the sterno-mastoid muscle is seldom necessary and that the facial nerve should never be injured. They once opened the pleura accidentally, with no ill result, and have never found it necessary to excise any portion of the internal jugular vein. In extensive and doubtful cases, drainage should be employed, but they use a narrow-gauze wick and remove it usually after twenty-four hours. As to the end-results, they report that 75 per cent. of the cases are cured, but, in about 10 per cent. of these recurrence might be expected or a second operation needed; 15 per cent. are improved, viz., those with sinuses or unoperated glands; 9 per cent. left the hospital with discharging sinuses and other tubercular signs; 0.5 per cent. left the hospital in a weak condition with general tuberculosis, and 0.5 per cent. died. One death was due to meningitis on the twenty-first day, and 3 to general debility, with diarrhea and tubercular fever, from the twentieth to the fortieth day after operation.

Ladd<sup>1</sup> reports a series of 40 cases operated on, with one death, a few days after operation with symptoms suggesting meningitis. Of the remaining 39, 30 were followed at periods of time from three months to two years, the other 9 having been operated too recently to suggest the probability of their cure. Of the 30 patients followed, 25 were apparently cured, *i. e.*, they showed no signs of recurrence, no palpable glands, and were in good general condition. In about three weeks they began to have a better appetite, put on flesh, improve in color and did not need medical attention other

<sup>1</sup> British Medical Journal, 1914, clxx, 532.

than instructions about their mode of living. Of the 5 not apparently cured, 1 showed no palpable glands but was in poor general condition; 2 patients had recurrence on the opposite side of the neck; 1 has a few small glands along the posterior border of the sternomastoid muscle; 1 has a small swelling in the scar. Of the series reported, only 11 were operated on at a favorable time for operation. It will thus be seen that Ladd reports 83 per cent. of operative cures, practically the same as that reported from my clinic by Müller, in 1913. The tonsils were examined in 16 of these cases, and in 10 (62.5 per cent.) unquestionable tuberculosis was found histologically. He also reports that, curiously, the tuberculous tonsil, with one exception, failed to show any evidence of tuberculosis. His conclusions are in thorough agreement with our own, as shown in the paper by Müller. It takes too long to treat patients by the x-rays or by tuberculin; it takes too much of the patient's time or of the parents' time if the patient be a child. As Ladd says, "to advocate the head of a family losing a half-day a week for six months or more should be avoided when possible." He also states that the primary focus *must* be removed at the time of the adenectomy, and he also states that to avoid unsightly scars and to insure first intention wounds, patients should be operated on early, before the glands have broken down.

Stevens<sup>1</sup> discusses the *relation of tuberculous glands in the neck to disease of the nose and throat*, and advocates radical operation for their removal. He also states that "the non-surgical treatment means a prolonged treatment extending over months or years during which time a local trauma or generally lowered resistance may cause sudden activity, with greater destruction of the tissue and widespread infection. The x-rays have no place in the treatment of this condition unless it be in the very rare cases with persistent tuberculosis of the skin following operation." He reports 407 operations, apparently from the clinic of W. E. Schroeder of the Northwestern University Medical School. 75 per cent. of the individuals were traced, with a mortality of 2 per cent. of deaths during the first 1½ years following operation, and 7 per cent. of recurrences. His paper discusses the technique of operation followed, but does not require presenting.

Finally, Stauffer,<sup>2</sup> in an excellent paper written especially from the standpoint of the rhynologist, concludes that in order to secure permanent cure in tuberculous cervical lymphadenitis, we should emphasize:

1. Early cleansing of nose, teeth and ears.
2. Early removal of adenoids and tonsils by complete dissection.
3. Early adjustment of irregular teeth or filling of decayed teeth or removal of decayed roots.

<sup>1</sup> California State Journal of Medicine, 1914, xii, 136.

<sup>2</sup> New York Medical Journal, 1914, c, 705.

4. Early mastoid operation for any purulent otitis media present.

5. Plenty of good food, regular baths, exercise, and plenty of sleep.

There has not been much written upon the röntgen treatment of tuberculous lymph nodes, although I suppose that numerous references to such treatment are scattered throughout the literature. Philipowicz<sup>1</sup> reports twenty-five cases showing that the röntgen rays are the most effectual of all measures. All of the twenty-five patients were moderately improved; about fifteen exposures, given once in one or two weeks, are generally required. He does not advise röntgen treatment in those under the age of ten, owing to the danger of interfering with the growth processes. Note again the period of time and the continuous use of the word, "improvement" in this and other articles. For instance, Petersen<sup>2</sup> believes that the therapeutic action of the röntgen rays in tuberculous lymphadenitis is better than in any other lesion. He agrees with Iselin that a total of six full doses should be the limit in one course. He waits for a month between successive sittings and then suspends this treatment for several months. One point in Petersen's paper is of interest, and that is that while the young cells of the tuberculous tissue are superficially sensitive to the rays, the tubercle bacilli themselves do not seem to be directly affected. For this reason the bacilli may be merely walled in, as in any old encapsulated, cheesy process, and infection may flare up again if occasion offers.

**The Carotid Body.** Last year, in discussing the interesting paper by Callison and Mackenty on Tumors of the Intercarotid Paraganglion, I devoted several pages to the pathological and clinical aspects. Several additional papers have appeared this year, the most important of which is that by Balfour,<sup>3</sup> with a description of the anatomy, physiology and pathology by Wildner. Balfour simply reports his case. Wildner advances the hypothesis that a carotid gland tumor is only an anatomic expression of a functional disorder of the chromaffin system affecting one or more units of the same. The structural unit of the intercarotid is a chromaffin cell, and its rich vascularization indicates a very active metabolism.

The patient operated on suffered from an edema of the thyroid gland and, after removal of this and ligation of the vessels, further investigation revealed a separate mass in the right submaxillary region, firmly adherent to the surrounding structures and intimately connected with the deep vessels. The mass was dissected from the carotid vessels but it had invaded the internal jugular vein and it was necessary to remove about four inches of this structure. The patient recovered from the operation but shortly developed a hemiplegia which has persisted, and, at the time of the report, there was a probable local recurrence.

<sup>1</sup> *Wien. klin. Woch.*, 1914, xviii.

<sup>2</sup> *Therap. d. Gegenw.*, 1914, 1.

<sup>3</sup> *Surgery, Gynecology, and Obstetrics*, 1914, xlviii, 806.

Funke,<sup>1</sup> who was associated with Keen in a previous paper, presents a general review of the subject without presenting anything new or reporting any new cases. He mentions that recently he has seen two growths to be reported later. In the discussion of this paper, Hollway reported a case of carotid tumor removed by operation, with recovery and cure of the patient for at least six years. Levings<sup>2</sup> also presents a paper and reports one case. The tumor was diagnosed as a lymphosarcoma and, at operation, the jugular vein was found to be obliterated. A portion of the vein and the tumor were removed, and, in so doing, it was necessary to strip the carotids for several inches. The man made a good operative recovery, but in three weeks there was a recurrence. This was removed, and the patient given Coley's fluid. In a few weeks the entire area, about two inches, became infiltrated and hard, and the patient died about 4½ months after the first operation.

Finally, Da Costa<sup>3</sup> writes a very entertaining paper and reports a new case. He refers to his first reported case in 1906 and states that because of the poor result in this case he became very conservative about operating for carotid tumor. He then became more optimistic, however, and came to believe that when the carotid gland is either palpable or visible, it is pathologic, will grow larger, will eventually become malignant, and should be removed at once. He then observed and operated on another case. The patient is perfectly well, fourteen months after the operation. The third case was considered inoperable because of bilateral enlargement, because both tumors were large and already had nerve and vascular involvement, and because removal of both bodies would almost certainly demand ligation of both common carotids. The patient died in a few months from advanced exhaustion and severe dyspnea, and removal of the tumor postmortem showed them to be peritheliomata of the carotid bodies.

Da Costa states that this is the only case on record of bilateral carotid tumor, but Balfour and Wildner in their paper state that, in a personal communication from Enderlen, he had observed a bilateral overgrowth of the carotid gland. Da Costa's conclusions are as follows: First, that the carotid body exists more frequently than was formerly believed; that it is of unknown function; that it should undergo fibrous atrophy at or soon after puberty; that if such atrophy fails to occur, the body will probably enlarge and such enlargement is to be regarded as a tumor. Second, tumors of the carotid body are of the type of endotheliomata known as peritheliomata. Third, these tumors, originally innocent, usually pursue a long course. Rapid growth is exceptional until years have passed. Sooner or later they tend to take on rapid growth and to cause functional involvement.

<sup>1</sup> Southern Medical Journal, 1914, vii, 554.

<sup>2</sup> Wisconsin Medical Journal, 1914, xiii, 17.

<sup>3</sup> New York Medical Journal, 1914, xcix, 253.

Rapid growth signifies malignancy. A malignant change is sarcomatous in character. Fourth, the growth is almost invariably unilateral. Fifth, the carotid body is associated intimately with important vessels and nerves, its position being retrocarotid rather than intercarotid. It has a large blood supply which is carried by the ligament of Mayer. Any injury to the body produces profuse hemorrhage and, if an operation is once started, it must be completed or the man will probably bleed to death. The relations of the carotid body render any operation difficult and dangerous, and make postoperative complications probable. Sixth, the carotid body is intimately associated with nerves, involvement of which will produce symptoms. Tumors are lifted by the pulsating carotid artery, and are movable laterally, but not up and down. Seventh, operative interference is comparatively safe when the tumor is recent and small, but is fraught with grave peril when the tumor is old and with especial danger if it is large. The larger and older the tumor, the more probable it is that ligation of the common carotid or of all the carotids will be necessary in the removal, and that injury to important nerve structures will be almost inevitable. Early operation will enable us to dissect the tumor from the carotids, or to get off with tying the external carotid alone. As these growths tend strongly to become malignant eventually, as early operation is reasonably easy and comparatively safe, as late operation is difficult and highly dangerous, and as sooner or later the tumor, if left alone, will kill the patient, early operation is imperative.

In reporting a case of bilateral carotid tumor operated on by Enderlen, Schmidt<sup>1</sup> presents an interesting study showing the effects of the removal of the carotid glands in nine cats; cats were selected because of the greater capacity of the gland. As a result of these experiments, he found that bilateral removal of the carotid gland produces no injurious symptoms. He does not believe that the glycosuria observed by Vassale after exploration was caused by the operation but rather was due to the anesthetic. He also does not agree with Frugoni that animals were more sensitive to adrenalin after removal of the carotid, because such did not take place in his experiments. He believes there are thirty-eight cases in the literature and starts his collection from that of Neubauer. Needless to say he has omitted many cases, especially those outside of Germany. In the case operated on by Enderlen, it was necessary to resect the carotid, followed by end-to-end suture of the common to the internal carotid on the left side. Seven weeks later the right carotid tumor was removed without injury to the vessels.

**Cervical Ribs.** Last year I discussed this subject in some detail and did not think it would be necessary to offer any further discussion

<sup>1</sup> Beitr. z. klin. Chir., 1914, lxxxviii, 301.

for some time, but several papers which have appeared since seem important enough to warrant abstracting, especially as they give good descriptions of the operative technique. Hamilton<sup>1</sup> discusses the subject from the standpoint of a brachial neuritis. He divides the symptoms into four groups:

1. Arterial. 2. Vasomotor. 3. Sensory. 4. Motor.

He discusses the two last groups in detail. The subjective sensations vary considerably in different cases, but they generally extend from the shoulder to the hand and are most commonly severe in the area of distribution of the first thoracic and eighth cervical nerves. Other regions of the arm, however, are by no means free; this is especially true in the cases of short ribs which irritate cords higher up in the brachial plexus, the patients complaining of pain, numbness, tingling, and various paresthesias. Touch, pain, temperature, vibration and joint sensibility are also involved but not always to the same degree. As to the matter of symptoms, atrophy and weakness in the hand and arm muscles are present in many cases and, when confined to the abductor, opponens and flexor brevis pollicis, a very frequent location, constitute one of the most characteristic features of the disease. Hamilton remarks that it is surprising that whereas these muscles are supplied by the median nerve, the ulnar distribution gives the most sensory trouble. He calls attention to the association with syringomyelia and cautions us that pain and tingling in the hands and arms, especially at night, may also be due to rheumatism, syphilis, alcohol, or to deficient blood supply and may be associated with the climacteric and with senility.

Following this paper, Law<sup>2</sup> discusses the surgical aspect of cervical ribs and reports two cases, in one of which he removed both ribs in the same individual. He prefers vertical incisions paralleling the border of the scalenus medius which permit a perfect access to the rib region. It is imperative that a careful dissection of the subclavicular artery, scalenus anticus muscle and lower border of the brachial plexus be made. The nerve and arteries should be gently drawn aside and the insertion of the muscle into the ribs severed with due regard for the phrenic nerve. After the muscle is severed, the artery is mobilized and drawn downward, and the brachial plexus upward and backward. The rib is then severed through its neck with bone-cutting forceps, and its inner surface carefully separated from the attached dome of the pleura; its intercostal muscles cut; and the costal cartilaginous attachment divided. The suggestion of McKenna may be adopted at this point, and a small muscle flap from the scalenus medius brought down over the nerves and artery for protection. Law cautions against wounding the thoracic duct on the left side.

<sup>1</sup> *Journal-Lancet*, 1914, xxxiv, 321.

<sup>2</sup> *Ibid.*, 330.

Potter<sup>1</sup> reports one case and briefly describes the condition. He operates through an incision 6 cm. in length along the posterior border of the sternomastoid muscle and extends it slightly outward along the upper clavicular margin. The important structures are exposed and separated from the rib, the plexus being retracted forward, and, after posterior separation of the rib, the plexus is retracted posteriorly and the artery anteriorly, and the rib separated and divided.

Henderson<sup>2</sup> reports 31 cases from the Mayo Clinic and, of these, 24 were bilateral. Eighteen of the patients suffered from no subjective symptoms, and they believe this to be due to differences in the site of exit of the nerve roots. It is not necessary to abstract Henderson's paper, although it is very complete, because of the full description devoted to this affection in 1913.<sup>3</sup> The operative treatment pursued by Henderson is as follows: "There are practically two methods of attack—the posterior and the anterior. The posterior incision is preferably a "hockey stick" over the anterior border of the trapezius. Dissection is made and continued down between the posterior border of the scalenus medius and the levator anguli scapulæ. In this zone the nerve to the serratus as it passes through the scalenus medius is in danger. The advantage of this incision is that the brachial plexus comes down between the scalenus anticus and medius, and is out of danger. The anterior incision is made through the posterior triangle of the neck and was the one used in all our cases. An incision is made about three or four inches in length an inch above and parallel to the clavicle, posterior to the sternomastoid. Dissection is then made down on to the rib, tying as many vessels as is necessary. By adhering closely to the cervical rib, injury to structures is avoided. If the rib be large, the subclavian artery is on top of it; if small, the artery is in front of it. If the rib be large, it should be taken out in pieces, but, if practicable, it should be removed whole."

**Ligation of the Innominate Artery.** Fifty-three cases, of which 14 were successful (26.4 per cent.), are reported by Hamann.<sup>4</sup> Most of the operations, however, were done in pre-antiseptic times and the most common cause of death has been secondary hemorrhage. In describing the technique, Hamann states that after following the usual plan it may be necessary to excise the inner part of the clavicle as a further aid in exposing the vessel. He does not countenance Milton's proposal to divide the sternum, nor Bardenheuer's osteoplastic resection of the manubrium. Removal of the right half of the manubrium and adjoining costal cartilages, and perhaps also the inner end of the clavicle may be resorted to. In clearing the artery, we should keep

<sup>1</sup> Journal Missouri State Medical Association, 1914, xi, 74.

<sup>2</sup> American Journal Orthopedic Surgery, 1914, xi, 408.

<sup>3</sup> PROGRESSIVE MEDICINE, March, 1913, p. 102.

<sup>4</sup> Annals of Surgery, 1914, lix, 962.

close to the common carotid and innominate artery to avoid injuring the important structures.

**Hygroma Cysticum.** Last year I abstracted Dowd's paper on this subject. Three additional cases are reported by Smith,<sup>1</sup> one of which was in the neck and the other two were axillary. Full description of the operations and pathological reports are appended.

**Neck Tumors.** Mackenty<sup>2</sup> reports the tumors of the neck met with in the Royal Victoria Hospital, Montreal, during the last ten years. There were 15 branchiogenic cysts, 5 branchiogenic carcinomas, 9 thyroglossal cysts, and one carotid body tumor. The article is well illustrated, and contains full embryologic and pathological descriptions, but, as it contains but little practical information, we will content ourselves with its notice.

**Tuberculosis of the Breast.** Anspach's paper was reviewed in these columns<sup>3</sup> in 1905. Since then I have noted the reports of several other writers, and find this year a complete résumé by Deaver and Herman,<sup>4</sup> who review the cases reported since Anspach's studies in 1904. Durante<sup>5</sup> reported two new cases and discusses the literature. Deaver and Herman report five new cases. They divide *tuberculosis of the breast* into primary and secondary groups, the former including those in which the disease is confined to the breast and axillary nodes of the same side. They evidently regard this type as actually being quite rare and many of the primary cases so-called are so considered because the original focus is undemonstrable. Secondary mammary tuberculosis occurs as a result of foci located in the axilla, cervical and retrosternal lymph nodes and the adjacent ribs, sternum, pleura, and lungs.

From the description of the clinical aspects of this disease, I might pick out the following interesting points. Deaver and Herman accept 87 cases of primary tuberculosis of the breast reported since 1881 and this, when compared with the morbidity of tuberculosis generally, shows the extreme rarity of this lesion. They state that 60.9 per cent. of the primary cases and 41.9 per cent. of the secondary cases occurred between 30 and 50 years of age, although I notice that the decade previous to 30 furnishes more cases than the decade over 40. Heredity, trauma, antecedent mastitis, etc., do not seem to be particularly important as etiologic factors. The most frequent initial symptom of tuberculous mastitis was a painless lump. Pain was the second most common symptom and, as a rule, was only slight, rarely referred, and especially noted during the stage of abscess formation and just prior to rupture. The x-rays are of importance in differentiating osteitis of

<sup>1</sup> Journal of American Medical Association, 1914, lxii, 522.

<sup>2</sup> Surgery, Gynecology, and Obstetrics, 1914, xix, 141.

<sup>3</sup> PROGRESSIVE MEDICINE, March, 1905.

<sup>4</sup> American Journal Medical Science, 1914, cxlvii, 157.

<sup>5</sup> Policlinico, 1914, xxi, 309.

the underlying ribs. The average duration of the disease in the primary cases was 10.1 months and, in the secondary cases, 11.2 months. The rapidity of the disease process, changes in the size and consistency of the tumor mass, early fistula formation, early involvement of the axillary lymphatics and, in a few instances, pain, bring the great majority of the subjects of tuberculous mastitis to the surgeon within the first year of the disease. Tenderness, usually slight, is noticed in the later stages, but, like the other subjective symptoms, offers little aid to differential diagnosis.

An interesting fact is that tuberculous mastitis is not only compatible with, but usually associated with, excellent general health, most of the cases occurring in robust women. The presence of fistulas, retraction of the nipple, and enlarged axillary glands is a triad strongly suggestive of tuberculous mastitis. They classify the pathologic types of mammary tuberculosis into: (1) acute miliary tubercular mastitis; (2) nodular (discrete, disseminated, confluent), tubercular mastitis; (3) sclerosing tubercular mastitis (Scott) (comparable to fibroid phthisis); (4) mastitis tuberculosa obliterans (Ingier); (5) various atypical forms.

It does not seem worth while abstracting the discussion of different types. Tuberculous mastitis must be differentiated from simple pyogenic mastitis, broken-down gummas, and actinomycosis when fistulae have formed. Sclerosing tuberculosis of the breast, especially in the absence of areas of degeneration, gives all the classical symptoms of carcinoma. Tumor of the breast gives the typical physical signs of fibro-epithelial tumors; simple cysts and sarcomas will not excite suspicions of a tuberculous origin. The tuberculin test has not been extensively used in the cases reported in the literature, but Deaver and Herman believe that it should be of value; they emphasize, however, the value of frozen section diagnosis of a doubtful tumor at the time of operation. Investigation of the discharge from the fistula and the Wassermann reaction, etc., and the use of the x-rays, as previously mentioned, may also serve in diagnosis. No reported cases of primary tuberculosis died as the result of operation. They quote from several writers showing that patients were relieved and well a number of years after the operation. There seems to be a good deal of omission in the writings on tuberculosis of the breast as to the subsequent state of these patients.

As to *treatment*, the vast majority of the cases were operated on, and Deaver and Herman advise excision of a localized tubercular mass in the breast of a young woman, with exploration of the axilla in the presence of palpable lymph nodes. In older women, simple amputation, with excision of the axillary nodes, is the method of choice. In either case, tuberculin should be given, since this in proper dosage can do no harm and may perhaps aid nature in overcoming any small

focus that might easily escape the knife. Conservatism had better be expressed in limiting the area of excision than in discarding operative treatment.

They give a tabulation of the cases reported since 1904, and a fairly complete bibliography.

**Chronic Cystic Mastitis.** We have made a study of the cases of chronic cystic mastitis admitted to my clinic in the University Hospital during the past ten years. I was surprised when Müller<sup>1</sup> collected eighteen cases only, but in a great many more the laboratory diagnosis was "chronic cystic mastitis and carcinoma" and these have been entirely excluded. Some of the cases in this group have previously been reported by Speese<sup>2</sup> and next year we expect to complete the series to date.

The clinical features are well known to most surgeons, but we find that most men in general practice have rather vague ideas upon the subject, and this cannot be wondered at considering the confused nomenclature and various descriptions of the pathology. The malady affects the breasts of women at an average of forty years, may involve one or occasionally both breasts, is associated with a certain amount of pain, occasionally referred down the arm, and, upon examination, a rather vague mass is felt, containing one or more hard nodules, and which is not adherent to the skin or to the underlying pectoral fascia. Examination of the axilla rarely reveals any enlargement of the nodes there.

Judd,<sup>3</sup> in reporting 218 cases of chronic cystic mastitis, eleven of which occurred in males, noted that 85 per cent. occurred during the "cancer age" (30 to 60 years). He found a history of previous mastitis in the greater number of his cases, and nearly all complained of pain. Hedinger<sup>4</sup> reports five cases of severe neuralgic pain in the breast, and operation revealed nothing but pre-senile involution. In a well-illustrated paper, Means and Forman<sup>5</sup> report 16 cases of this disease, the average age being 38.5 years; 15 were married women, and 14 of these had borne children. Pain was a prominent symptom, retraction of the nipple not observed, and in only 2 was there any prominent involvement of the axillary lymph nodes. Both breasts were involved twice. In our series, pain was the exception rather than the rule, and 89 per cent. were between 30 and 60 years.

TABLE I.—AGE INCIDENCE.

	Cases.
Between 10 years and 20 years . . . . .	1
Between 20 years and 30 years . . . . .	2
Between 30 years and 40 years . . . . .	5
Between 40 years and 50 years . . . . .	9
Between 50 years and 60 years . . . . .	1

<sup>1</sup> *Annals of Surgery*, 1914, lx, 595.    <sup>2</sup> *Ibid.*, 1910, li, 213.

<sup>3</sup> *Journal Michigan State Medical Science*, 1914, i, 11.

<sup>4</sup> *Berlin. klin. Woch.*, 1914, li, 517.    <sup>5</sup> *Ohio State Medical Journal.*, 1914, x, 336.

The youngest, fifteen years (male); the oldest, fifty years. Average age, thirty-eight years, eight months. Married, fifteen; single, two; male, one. Ten had borne children; four were childless. The menstrual history was of no importance in any case. In the family history the occurrence of cancer was noted in five instances; tuberculosis, twice, and in one of these tuberculosis and carcinoma both were present in the family history. Only two patients of the eighteen stated that they had injured the breast, and both ascribed the mass to the injury. In only one case was there a previous history of acute mastitis and in this patient there was also a history of trauma. Four of the patients, at least, were ptotic. The duration of the disease was very variable and any statements on this point would be inaccurate because often the patient would state that the "lump" had been present for a few weeks or months when it probably had existed for a longer period. One patient had only noticed the mass for three days and immediately came for operation. Another had noted the mass for five years, and still another stated that she had had masses in the breasts ever since she was a little girl.

Of these eighteen patients, a definite satisfactory letter has been received from fifteen, and in all of them cure has evidently occurred. The period of cure extends from eight months to nine years and seven months, and may be tabulated as follows:

TABLE II.—INCIDENCE OF CURE

	Cases.
Eight months to three years . . . . .	4
Three years to six years . . . . .	5
Six years to ten years . . . . .	6
Not traced . . . . .	3

The etiology is approached from a new standpoint by MacCarty;<sup>1</sup> I abstracted this paper last year. A second paper<sup>2</sup> reiterates his views and states that we should endeavor to solve the following problems:

"1. The percentage of cases of tertiary hyperplasia with or without glandular involvement, which may be cured after an arbitrary period of ten years from the time of radical operation.

"2. The percentage of cases of secondary hyperplasia which will remain well or recur after the removal of the mammary gland itself, without the removal of the glands, muscles, and large amounts of skin.

"3. The percentage of cases with local chronic mastitis or encapsulated conditions which return later, with secondary or tertiary hyperplasia, after local removal."

Dr. Müller has examined the slides of 14 of our cases for the purpose of classifying them according to the MacCarty scheme. In nine, the

<sup>1</sup> PROGRESSIVE MEDICINE, March, 1913, p. 102.

<sup>2</sup> Surgery, Gynecology, and Obstetrics, 1914, xviii, 284.

hyperplasia was of the primary type, *i. e.*, the growth was benign. In the tenth case the patient was operated on three times, twice in the left and once in the right breast, and in all three neoplasms primary hyperplasia only was found. In the eleventh case the mass in the left breast was excised subcutaneously and revealed the secondary type of hyperplasia, while a growth in the right breast, removed two years later, was of the primary type. In another case the right breast was removed in 1904 and showed primary hyperplasia. Six years later a mass was removed from high in the upper, outer quadrant of the remains of the breast, and showed a secondary hyperplasia. In two other cases the secondary type of hyperplasia was encountered. Of the four secondary hyperplasias, *i. e.*, the type which may or may not be carcinomatous, according to MacCarty, three of the patients were traced and reported cured five years, four years, and three years, respectively, after operation. Of the ten primary hyperplasias, eight have been traced, and all reported cured. The tertiary hyperplasias or carcinomas are not reported because we include them under the cancers. While this series is entirely too small to draw important deductions, it is interesting to note that the average age, at operation, of the patients with primary hyperplasias, was thirty-six; of the secondary hyperplasias, forty-one.

It will be remembered that MacCarty<sup>1</sup> considered, (1) the primary hyperplasia as frankly benign; (2) the secondary hyperplasia as doubtful, suggesting the possibility of carcinoma but without infiltration; and (3) the tertiary hyperplasia or carcinoma. Greenough and Simmons<sup>2</sup> believe, however, that the line between Class 1 and Class 2 will be hard to draw, and that the designation of any lesion as carcinoma, without evidence of infiltration of the stroma with epithelial cells, is a difficult feat for the most expert pathologist to attempt.

Means and Forman studied twenty of their most recent cancer cases; the average age was fifty-nine years; of these, eight (40 per cent.) revealed abnormal involution, and the average of these women was 47.1 years. They believe that abnormal involution is a precancerous state, not only because of the frequent association, but also because of the histologic features: First, a dense overgrowth of the stroma proper, with the resultant formation of retention cysts; second, the thickening of the bloodvessel walls and the disappearance of the periductal tissue; third, more or less activity on the part of the epithelium.

A similar line of thought animates Yosset and Masson,<sup>3</sup> who report 75 breast tumors removed during three and one-half years. Of these, 36 were examples of chronic cystic mastitis. Of 50 specimens exam-

<sup>1</sup> Surgery, Gynecology, and Obstetrics, 1913, xvii, 441.

<sup>2</sup> Annals of Surgery, 1914, lx, 42.

<sup>3</sup> Rev. de Gynec. et de Chir. Abdom., 1913, xxi, 257.

ined completed, 38 were cancers, and, of these, 25 were associated with cystic disease. They believe that cystic mastitis is the most frequent disease of the breast and that its coexistence with cancer is the rule and not the exception. They point out that the ducts become obstructed by proliferation of connective tissue or epithelium, the acini become dilated and cystic, or atrophy. The epithelial lining becomes hyperplastic in the former event and projects as papillæ into the cystic cavity. If the connective tissue is in excess, a fibro-adenoma results; if the epithelium is in excess, the cyst is filled up with a mass of epithelium and the border-line of carcinoma is reached. Todyo<sup>1</sup> offers a similar discussion and describes a stage of infiltration, of retention cysts, and of epithelial proliferation. Bertels<sup>2</sup> also believes that chronic cystic mastitis consists of a primary hyperplasia of the connective tissue, followed by cyst formation and then by epithelial hyperplasia which grades into carcinoma without any sharp line of demarcation. He reports 27 cases, 5 in males, and divides them into the usual groups.

When we come to discuss *treatment*, we are confronted with the opinions of those whose experience leads them to consider every case of chronic cystic mastitis as potentially malignant, and the possibility of mutilating a woman unnecessarily. The plan of treatment recently suggested by MacCarty deserves consideration. He believes that in doubtful cases in women near or over thirty-six years of age, they should have the entire mammary gland removed for immediate examination. If primary or secondary hyperplasia be present, nothing more should be done; if tertiary hyperplasia be present, a radical operation should be performed. In doubtful patients near or under thirty-five years of age, a wide section of the gland should be removed; and if primary hyperplasia be present, nothing more should be done; if secondary hyperplasia be present, the remainder of the gland should be removed; and if tertiary hyperplasia be present, the radical operation should be performed. Judd slightly varies this procedure and advises, in women under twenty-seven years of age, partial excision, preferably by the Warren method; in those between thirty and forty years he believes that the radical operation is the surest method, but prefers, for cosmetic reasons, to practice partial excision and to abide by the decision of the pathologist, doing a radical operation at the time, if necessary. In patients between the ages of forty and sixty, a radical operation should be performed, but the muscle need not be removed in definite benign conditions. In our own series of cases, resection of a portion of the gland was performed seven times; in one of these, at a second operation the breast was completely amputated and the axilla dissected out because of apparent recurrence two

<sup>1</sup> Archiv. f. klin. Chir., 1914, civ, 440.

<sup>2</sup> Deutsche Zeit. f. Chir., 1913, cxxiv, 9.

months later and we were fearful of carcinoma; no microscopic evidence of carcinoma, however, was found in either specimen, but, unfortunately, the patient has not been traced. In a second case the resection was followed, two and a half years later, by a subcutaneous excision of the entire breast for apparent recurrence. This patient returned a little later for a similar condition in the opposite breast which was also excised subcutaneously. She reports herself at the present time as being entirely well, and, curiously, on January 31, 1914, gave birth to a daughter, at which time the tissues over the chest were tender and there was a slight discharge from the nipple. Amputation of the breast was performed in the remaining eleven cases, in one being accompanied by a dissection of the axilla, and in another a radical operation was done for recurrence two years after the excision. Both these cases have been traced and are perfectly well. One patient who had both breasts operated on, with a complete amputation on one side and a subcutaneous excision on the other, much prefers the former operation, stating that the remaining nipple is quite tender.

Greenough and Simmons have traced 83 cases, all of which had partial removal only performed, and in 14 both breasts were removed. Of these, 17, or 20 per cent., were unsuccessful. In 4 cases (4.8 per cent.) carcinoma occurred in the breast tissue left by the partial operation; in 5 cases (5.9 per cent.) the disease recurred in the other breast; in 8 cases (9.6 per cent.) the disease returned in the breast tissue left by the first partial operation. They prefer "subcutaneous amputation" or "elliptical amputation" in all cases, the latter being best when grave doubt of the diagnosis is present. Finally, just as Bloodgood has insisted, exploratory removal of a nodule for pathologic examination, they believe to be a very dangerous procedure.

**Cancer of the Breast.** Last year I discussed the large series of cases reported respectively by Deaver and Primrose. We now have a larger group reported by Judd and Sistrunk<sup>1</sup> from the Mayo Clinic. The patients were operated on during the period of ten years from January 1, 1902, to January 1, 1912. During this time 609 patients (607 females and 2 males) were operated on, and they have traced 514. No patient died in the hospital, but 3 died within one month after the operation—1 from pulmonary embolism in two weeks; 1 from diabetic coma at the end of the fourth week; and 1 from sepsis at the end of the fourth week.

Five women under thirty are alive and without recurrence at various periods of time. Rodman<sup>2</sup> states that he has "had many such patients." These observations are important in view of the current belief as to the hopelessness of cancer in women under thirty-five.

Of the patients operated on more than ten years ago, 40 were traced,

<sup>1</sup> *Surgery, Gynecology, and Obstetrics*, 1914, xviii, 289.

<sup>2</sup> *Annals of Surgery*, 1914, lix, 47.

and 13 (32.5 per cent.) are alive without recurrence and 3 of the 27 deaths were from other causes than cancer. Of the 321 patients operated on more than five years ago, 266 have been traced; 106 are living (39.8 per cent.), of which 6 have recurrence; of the deaths, 14 died from other causes. Of 510 patients operated on more than three years ago, 427 have been traced; 191 are living (44.7 per cent.), of which 27 have recurrence; 19 are known to have died of other causes.

Five of the patients suffered from late recurrence, one patient dying nine years and one month after operation from carcinosis; another was operated on for recurrence twelve years after the primary operation. They give examples showing that excision of the tumor or part of the breast, followed by a radical operation within a few days or weeks, does not always mean a bad prognosis. They have been troubled with edema and swelling in only about 5 per cent. of their cases. They note that edema occurs in two ways: first, as primary edema immediately following the operation. This is quite common, and we believe it is due to a thorough removal of the lymphatics; it persists until collateral circulation in the lymphatics has been established. This is usually a matter of two or three weeks and can be relieved by early exercise and massage. Second are those patients in whom the edema comes on late—several months or years after the operation. Here it is due to a recurrence of the carcinoma in the remaining lymphatics which have been draining the arm, and, of course, is permanent. In four patients we have removed the entire axillary vein down to the cephalic vein, taking care that the latter was not injured. The resulting edema was but slight and temporary. Even with the removal of the pectoral muscles, intercostals, part of the latissimus dorsi and serratus magnus, and all the axillary fasciæ and lymphatics, in many of these cases the function of the arm and shoulder has been impaired very little." They remove the entire breast, axillary glands, and fasciæ, including the pectoralis major and minor muscles in every case. They note the tendency in recent years to remove more widely the subcutaneous and deep fasciæ in all directions. They rarely operate if the supraclavicular glands are proved to be involved. They sometimes use the Jackson or Rodman technique. Guthrie<sup>1</sup> reports that he has used the Rodman operation in 74 instances, and considers it one of the best radical operations. The main feature of this operation is the primary axillary dissection. Guthrie does not employ drainage except in fleshy persons or when there has been an undue amount of trauma. Personally, I prefer a drainage tube for twenty-four hours to carry off the serum and recently have been ligating with fine silk in a number of cases.

<sup>1</sup> Journal of American Medical Association, 1914, lxiii, 1256.

A review of the "Murphy Clinics" reveals quite a few "talks" on cancer of the breast. His technique is about as follows: The breast is encircled by two elliptical incisions extending from the outer and upper border to the lower and inner, and down to the pectoral fascia. The breast and pectoral fascia are then removed. The pectoralis major is freed from its costal attachment and reflected outward on the arm, splitting it well up to the clavicle. The fascia and fat between the pectoral muscles are then removed and the pectoralis minor, detached from its costal attachment, is deflected outward. The axilla is then dissected out *en masse*, beginning at the apex and proceeding downward and backward. All aponeuroses and fat must be removed, but the muscles are saved to wrap over the vessels and prevent edema; they are sutured to the axillary structures by tacking stitches. The long subscapular nerve is always carefully preserved. He introduces a drain, usually through a stab at the lowest angle of the wound, to carry off the oozing.

Murphy does not think that the muscles are involved in the carcinomatous spread except in very rare instances. Ruth<sup>1</sup> is in agreement with this view and since 1904 has been dividing the pectorals from the clavicle to the lower border of the axillary space; the distal part of the pectoralis is later brought back and carefully sutured to the thoracic wall above and to the latissimus dorsi and teres major below, directly in contact with the axillary vessels and nerves. Like Dr. Murphy, he does not think that the muscle is invaded by carcinoma.

In the discussion of this paper, Morris and Dickinson took exception to this view, and Eastman<sup>2</sup> pointedly states, in regard to leaving the pectoralis that Dr. Murphy "is accustomed to doing that, and continued to do it in the face of anatomical reason for the removal of the pectoral muscle." Lockwood,<sup>3</sup> in a vigorous protest against the incomplete operation, states that "a cancer which is adherent to the pectoral fascia has certainly grown into both fascia and muscle."

Speaking of an incomplete operation reminds me of a letter received last November from Dr. Chace, of Nome, Alaska. He observed an Eskimo woman, aged thirty years, who fell on the ice in April and shortly after noticed a lump in the right breast. In September, a movable mass was found, and an "incomplete" operation was done by a surgeon with immediate aggravation of symptoms, metastasis and involvement of the axillary glands. She lived six weeks. Dr. Chace states that this is the second case of cancer of the breast that he has seen among the Eskimo in eighteen years.

<sup>1</sup> American Journal of Obstetrics, etc., 1914, lxi, 80.

<sup>2</sup> Journal Indiana State Medical Association, 1914, vii, 56.

<sup>3</sup> British Medical Journal, 1914, i, 1105.

**OÖPHORECTOMY FOR BREAST CANCER.** The ghost of Beatson's idea walks again. Torek<sup>1</sup> reports a case of a woman, aged fifty-seven years, with recurrent nodes on the chest, five years after amputation of the breast for carcinoma, who was operated on for fibromyoma of the uterus and both ovaries removed with the uterus. Eight and one-half months later not a trace of the nodes could be found.

**RÖNTGEN RAYS FOR BREAST CANCER.** Fifteen cases are reported by Pfahler,<sup>2</sup> which showed encouraging results. Four of these were reported in the paper abstracted in these pages last year. He concludes that "since the cases reported prove that extensive recurrent malignant disease can be made to disappear, the best time to treat with the rays is immediately after operation when least disease is present. This post-operative treatment should be thorough and given with the same care that would be used with palpable disease."

**RADIUM IN BREAST CANCER.** Many contributions have appeared upon the use of radium in cancer, and this method of treatment is quite "popular" at the present time. I am making a vigorous attack on a fairly large series of cancer cases, operable and inoperable, with radium and other forms of treatment, and will discuss the entire subject next year. The report of the London Radium Institute<sup>3</sup> for 1913 confirms, on the whole, the conclusions of the previous year. 972 cases were treated, of which 18 were cured, and 56 apparently cured. 123 cases of carcinoma of the breast were treated, with only 2 apparent cures.

**Exophthalmic Goitre.** The etiology of exophthalmic goitre is still under discussion. No doubt the physiologists and physiological chemists will soon produce experimental evidence clearly defining the cause of this affection. Three interesting papers have been published by Farrant.<sup>4</sup> A large number of experiments are described, and he shows that the pathological changes of exophthalmic goitre could only to a certain extent be reproduced by thyroid feeding in various animals. In the third paper, he states that "exophthalmic goitre is due to a combination of toxemia of an intensity sufficient to cause a hyperplasia with absorption of the colloid material. One acts during a period sufficient to give rise to a complete hyperplasia, associated perhaps with slightly marked signs of hyperthyroidism without necessarily any glandular enlargement. The supervention of another infection stimulates the gland, which usually enlarges, and the signs of hyperthyroidism become very evident. The case devolves into one of typical exophthalmic goitre. A nervous shock may lead to the diagnosis by suddenly bringing into evidence the symptoms of hyperthyroidism, especially those connected with the nervous system."

<sup>1</sup> *Annals of Surgery*, 1914, vol. lx, p. 476.

<sup>2</sup> *Surgery, Gynecology, and Obstetrics*, 1914, xviii, 90.

<sup>3</sup> *British Medical Journal*, 1914, i, 1107.

<sup>4</sup> *Ibid.*, 1913, ii, 1366; 1914, i, 470; 1914, ii, 107.

Some observations have been published upon the nerve control of the thyroid gland by Ossokin<sup>1</sup> and by Rahe, Rogers, Fawcett and Beebe.<sup>2</sup> The first named follows the work of Asher, and the collaborators at Birne and he concludes that the vasomotor fibers for the thyroid gland lie chiefly in the laryngeal and also in the superior and inferior pharyngeal nerves. The other investigators, working in the Cornell Medical School, studied the iodine content before and after stimulation of the nerves. As a result of these experiments, they found there was a loss of iodine from the thyroid gland in every case after nerve stimulation; it is evident, therefore, that the thyroid gland is under partial nerve control and that its physiologically active substance is discharged into the circulation in response to a nerve stimulus.

When we review the numerous "causes" of hyperthyroidism that have been advanced, we are struck with the frequency of "toxemia," "poisonous substances," and so on; whether these be in the water, microörganismal or intestinal; acute infections, pregnancy, worry, shock, etc.; it is evident that a great variety of conditions produce a stimulus, partly through the nervous mechanism and partly through the circulation, which induced hyperplasia of the gland and the symptom-complex of hyperthyroidism.

Blackford and Sanford<sup>3</sup> report some experimental work from the Mayo Clinic showing that extract of exophthalmic thyroids and the sera from certain cases of exophthalmic goitre contain a powerful depressor substance, present in direct proportion to the clinical acuteness and severity of the disease. The sera from patients with non-hyperplastic thyroids do not have a depressor action. Drinker and Drinker<sup>4</sup> studied the effect of extracts of sheep's and human thyroids on the fatigue curve of voluntary muscle. Extracts from colloid goitre gave, in most cases, no depression; and in all less depression than was obtained with either the sheep's thyroid or with extracts of exophthalmic goitres.

There is little or no speculation on the part of those writing from the Mayo Clinic as to the factors which lead to the definite pathologic changes which uniformly occur in exophthalmic goitre. Wilson,<sup>5</sup> in 1913, stated "that the relationship of primary hypertrophy and hyperplasia of the parenchyma of the thyroid to true exophthalmic goitre is as direct and as constant as is primary inflammation of the kidney to the symptoms of true Bright's disease."

Last year I abstracted the description of the types into which Plummer and Wilson group certain of the forms of goitre. In a later

<sup>1</sup> *Ztschr. f. Biol.*, 1914, lxiii, 443.

<sup>2</sup> *American Journal of Physiology*, 1914, xxxiv, 72.

<sup>3</sup> *American Journal of the Medical Sciences*, 1913, cxlvi, 796.

<sup>4</sup> *Ibid.*, 1914, cxlviii, 41.

<sup>5</sup> *Ibid.*, 1913, p. 781.

paper, Wilson<sup>1</sup> compares in tabular form the characteristics of the "exophthalmic" and "simple" goitre cases.

CLASSIFICATION (IN PERCENTAGES) OF THE PRINCIPAL PATHOLOGICAL CHANGES  
IN 3564 THYROIDS REMOVED AT OPERATION FOR GOITRE.

1208 thyroids from patients on exophthalmic goitre list		Principal pathological changes	2356 thyroids from patients on simple goitre list	
Clinically true exophthalmic goitre.	79%	Primary hypertrophy and hyperplasia of parenchyma.	0.6%	Clinically 17% toxic non-exophthalmic goitre.  and 83% non-toxic goitre.
	(3%)	A Early.		
	(34%)	B Advanced.		
	(41%)	C Regressing.		
Clinically toxic non-exophthalmic goitre.	11%	Secondary regeneration of atrophic parenchyma.	9.0%	
	10%	D		
	(4%)	Adenomas.	45.0%	
	(5%)	E Fetal.	(6%)	
	(1%)	F Degenerating fetal.	(17%)	
		G Adult.	(22%)	
		Primary atrophy of parenchyma.	44.0%	
		H Adenomatoses, diffuse colloids, etc.		
		Malignant tumors.	1.5%	

It will be noted that 17 per cent. of the 2356 simple goitres were of the "toxic non-exophthalmic type," and a study of these is presented by Wilson.<sup>2</sup> Plummer<sup>3</sup> has divided these cases, clinically, into (1) a group in which the cardiac toxin predominates and in which the clinical picture closely resembles, and in many instances cannot be differentiated from, the cardiovascular complex resulting from alcoholic, leptic, septic, and other well-known toxins; (2) A group more closely presenting the picture of Graves' disease, and including the cases that have been erroneously so diagnosed by the mass of the profession.

Now Wilson, in his study, found that one-half of the thyroids from the toxic non-exophthalmic cases which more closely resemble true exophthalmic goitre (clinical group 2) are of the regenerative type, and nearly all the remainder are fetal adenomas, while, in contrast to this, only one-eighth of the thyroids from the toxic non-exophthalmic cases which do not resemble true exophthalmics (clinical group 1) are of the regenerative type, less that one-fourth are fetal adenomas, and more than three-fifths of them are adenomas or colloid adenomatoses with adult and atrophying parenchyma.

This classification, which conforms with extraordinary mathematical accuracy to the clinical syndromes of goitre, should, I believe, be adopted and serve as a working basis in the elaboration of our plan of treatment. In an analysis of my own records, I<sup>4</sup> find that 35.7 per cent. belonged to the non-hyperplastic-atoxic group, 31.6 per cent. to the hyperplastic-toxic group (see Table 1).

<sup>1</sup> Journal of American Medical Association, 1914, lxii, 111.

<sup>2</sup> American Journal of the Medical Sciences, 1914, cxlvii, 344.

<sup>3</sup> Ibid., 1913, cxlvi, 790.

<sup>4</sup> Annals of Surgery, 1914, lx, 583.

TABLE I.

Pathological diagnosis.	Non-hyperplastic non-toxic.	Non-hyperplastic-toxic.	Hyperplastic-toxic.	Total.
Simple . . . . .	20	14	..	34
Adenoma . . . . .	12	17	..	29
Carcinoma . . . . .	2	..	..	2
Sarcoma . . . . .	1	..	..	1
Exophthalmic . . . . .	..	..	15	15
Ligation cases . . . . .	..	..	17	17
	—	—	—	—
Total . . . . .	35	31	32	98

SYMPTOMATOLOGY. The clinical picture of thyrotoxicosis has been so frequently described as to permit of no amplification. The relative frequency of the various symptoms is expressed in tabular form and calls for no especial comment. Mention might be made of an unusual phenomenon in one of my series—a periodic swelling of the upper lip synchronous with exacerbations of the disease and the development of a Bell's palsy. Whether the former was the outcome of some vaso-motor disturbance of sympathetic origin is an interesting question. The Bell's palsy may have been incidental or perhaps toxic.

TABLE II.—SHOWING SYMPTOMS OF TOXIC CASES.

Pathological diagnosis.	Cerebral symptoms.	Vasomotor disturbances.	Mental irritability.	Tachycardia.	Tremor.	Exophthalmos.	Cardiac insufficiency.	Loss in weight and strength.	Diarrhea.	Edema.	Headache.	Jaundice.	Vomiting.
Non-hyperplastic-toxic (simple) . .	1	2	10	10	9	3	10	3	1	1	1	..	..
Non-hyperplastic-toxic (adenoma) .	..	8	17	17	4	..	17	6	2	2	2	1	..
Hyperplastic-toxic .	..	4	15	15	6	14	10	5	6	2	2	2	2
Toxic cases in which ligation was performed . . . . .	1	6	1	17	10	16	12	7	9	3	1	..	6
Total . . . . .	2	20	43	59	29	33	49	21	18	8	6	3	8

In discussing certain aspects of thyroid disease, Rogers<sup>1</sup> states that exophthalmic goitre and hyperthyroidism are not synonymous terms, the former being the terminal stage of a chronic process which begins with simple "hypertrophy of the thyroid." The enlargement of the gland is often accompanied in the beginning by at least traces of deficiency in its functional activity (hypothyroidism). The third stage, which may entirely hide the second, is marked by the pulse and nervous manifestations of hyperthyroidism. Finally, in the fourth stage we have the cardinal symptoms developed—tremor, tachycardia, exoph-

<sup>1</sup> Annals of Surgery, 1914, lx, 281.

thalmos—or, exophthalmic goitre. The stage of hyperthyroidism is chronic, of long duration, accompanied by an increase in arterial tension, and then the development of cardiac, nephritic and other degenerative lesions.

If the patient survives for some time, after the appearance of the exophthalmos, a myxedematoid state results. This is termed the fifth stage by Rogers.

A certain number of cases of thyroid disease do not present the regular group of symptoms and can, for the most part, be classified into two types. Sometimes the goitre is lacking, and nervous and cardiac symptoms are irregularly present. Careful examination often will reveal a perceptible enlargement of the gland, or other symptoms of hypothyroidism, and then myxedema or hyperthyroidism and then exophthalmic goitre will succeed one another in the history of the patient. If improvement has occurred when the symptoms of hyperthyroidism were present, the symptoms passed back through the alternating stages of hypothyroidism and hyperthyroidism. In the other group the goitre may be large and unmistakable, but the other symptoms are irregular, and the patient mostly suffers from headache, nervous irritability, mental and physical asthenias, etc. The symptoms may suggest that the thyroid disease is the result and not the cause, but careful watch should be made on the progress of events in either hypo- or hyperthyroid conditions.

In a third group, termed by Rogers "dysthyroidism," the disease of the gland is local, as by a cyst or adenoma and the symptoms are completely relieved by the removal of the lesion. He gives a tabulation of the symptoms of hypothyroidism and hyperthyroidism, and it suffices to state that the early signs of hyperthyroidism are mostly those of excessive activity in the sympathetic nervous systems; the skin is moist, the alimentary tract active, the circulation accelerated, and muscular reflexes exaggerated. In hypothyroidism the gland is soft, the skin pallid and dry, the alimentary tract sluggish, the circulation usually normal, and the musculature also normal but incapable of sustained activity. There is a marked and otherwise unexplainable asthenia.

Rogers evidently believes that all thyroid abnormalities begin as a hypertrophy to compensate for demands for a greater thyroid secretion; this excessive activity is normally followed by fatigue (hypothyroidism). When, therefore, thyroid abnormalities appear in childhood, their origin can be traced to the need of thyroid secretion to provide for rapid growth and development; if in a shop girl or school teacher or trained nurse, it is the result of the expenditure of energy by many organs already taxed to their limit. Pregnancy, infectious diseases, traumatisms, and many other conditions or circumstances, may thus originate or intensify thyroid disease.

**JUVENILE HYPERTHYROIDISM.** In 1512 cases of exophthalmic goitre operated on in the Mayo Clinic, there were five occurring in patients under ten years of age. The youngest was four; the oldest eight; all were females; Lewis<sup>1</sup> reports the cases and notes that while goitre, tremor, mental irritability, tachycardia and exophthalmos were present, the children were able to participate in the vigorous activities of their associates without apparent cardiac or muscular distress. This is interesting in connection with the average duration of symptoms, 11.8 months, because 9 months is sufficient in the adults to produce serious disturbances. Double ligation was performed three times, and in two patients a portion of the thyroid was resected, one being preceded by a single ligation. Prompt satisfactory results were obtained in all; it will be interesting to watch the future course of these individuals.

**TREATMENT.** We must still maintain that the treatment of exophthalmic goitre is surgical. Contrary to general opinion there is not only a relatively high mortality with cases medically treated, but even in those supposedly cured there is a prolonged period in which the patient is unable to do any work. When I am consulted by a patient with simple goitre, colloid or adenoma, I warn her that there is a tendency, in a considerable number of cases, for these to undergo changes which will affect the heart and nervous systems and eventually lead to permanent damage of the heart, kidneys, and liver; in exceptional instances, in later life, goitres may become cancerous. I can confirm the work of Plummer on the chance of a thyrotoxicosis developing in simple goitre, the statistics of my clinic giving a percentage of 41.1, while in the Mayo clinic the percentage was 23.

In regard to the toxic goitres, we distinguish between cases of a moderate severity and those of a more serious nature. Our advice to the cases of moderate severity depends upon their financial and social status. If conditions are such as to make it impossible to undergo an adequate course of treatment, with the necessary physical and mental rest, and perhaps change of environment, and if it will be necessary for the patient to return immediately after her treatment to conditions of employment which would predispose to relapses, we strongly urge immediate operation. In a number of mild cases, prolonged courses of treatment under competent physicians had been ineffectual and operation had to be resorted to. There have been no deaths in this series, and the results have been almost uniformly satisfactory. As to cases of more grave character, our plan has been not to give an opinion until the patient has been under observation for a week with absolute rest. Many of these cases come from a distance, are fatigued by travel, and are in a state of nervous excitement at the

<sup>1</sup> St. Paul Medical Journal, 1914, xvi.

time of the first examination. They are put to bed and the condition of the cardiovascular system carefully studied. Usually within a week the condition will improve sufficiently to justify operation, or at least to determine with greater intelligence the mode of treatment to be adopted. Mayo<sup>1</sup> states that the surgery of exophthalmic goitre is by no means emergent surgery, and all patients during periods of exacerbation should be considered as medical cases. Surgery is considered in the upwave of improvement.

It is no longer necessary to discuss the operative risk of goitre. In my series there were 80 thyroidectomies, with no deaths. In 17 ligations there were two deaths, both true exophthalmic goitres, one an acute case of six months' duration and the other a case in the terminal stage of the disease. There was also one death from thyroidectomy in a case of sarcoma in a boy aged eleven years. Mayo, in 1912, reported 276 cases of exophthalmic goitre without a death. In the cases reported at the German Surgical Congress, 883 in all, the average operative mortality was a little over 5 per cent. Dunhill, in 1912, reported 230 cases, with four deaths; and Kocher at the same time reported a total mortality of 3.4 per cent., markedly decreasing in his later series.

This decrease in the mortality is due to the greater familiarity of surgeons with the operative technique and especially to the fact that more patients seek operative interference at an early period of their disease than formerly.

It will be remembered that Kocher lays great emphasis on lymphocytosis and the decrease of the polynuclear cells as an index of the gravity of the case. I have not been able to confirm his position by the blood analyses in my cases. The average lymphocytosis in the grave cases was 30.2, and, in the moderate cases, 27.6. Baradulin<sup>2</sup> carefully studied eight cases of Basedow's disease and ten of simple goitre. He could not demonstrate a decrease of the total number of white cells in every case, but found, on the contrary, an increase in the same. The condition of the myocardium has served for me as the most reliable guide, and I note that Petren<sup>3</sup> considers the condition of the heart as the surest index of the necessity for surgical treatment. The acute exacerbations, the explosions of hyperthyroidism, should be regarded as a positive contra-indication. A dilated heart, failure of compensation, poor muscular sounds, are the danger signals, and will determine whether operation must be deferred or altogether abandoned. Had I recognized this condition and observed this stricture, I would not have operated when I did on one of my two fatal cases.

The question of *anesthesia* is an important one, and yet we find three different methods in three large clinics. Kocher uses local anes-

<sup>1</sup> Surgery, Gynecology, and Obstetrics, 1914, xviii, 322.

<sup>2</sup> Abstract in the International Abstract of Surgery, April, 1914, p. 349.

<sup>3</sup> Hygiene, 1914, lxxvi, 1009.

thesia; the Mayo Clinic use ether, and Crile uses gas-oxygen preceded by his well-known anoci association technique. I am thoroughly convinced of the advantages of anoci association, and while at first I mostly limited its application to the avoidance of harmful psychic stimuli before the operation, I have recently been infiltrating the wound with the novocaine and the quinine and urea as practiced by Crile. With reference to the advantages of scopolamine in all cases, I have been a little skeptical. At least in some cases it seemed to have a disturbing, rather than a sedative, action. In two cases particularly, the pulse was accelerated, and the patients become extremely restless and in one instance delirious. In this case, the operation was postponed because of this extreme excitation; at the time set for operation two weeks later, the scopolamine was omitted and this condition of excitation did not occur. The choice of operative methods must be left to the individual judgment of the surgeon. My rule has been to err always in favor of conservatism, to choose in doubtful cases ligation rather than lobectomy, one vessel rather than two, or in the more serious cases injection of boiling water rather than ligation. While I have had no experience with the boiling water injection, yet the recent papers of Porter have rather convinced me. The only two cases which died in the hospital as the result of operation were double ligation, and in looking over the records, I can clearly see the wisdom of substituting boiling water injections at least as a preliminary treatment for ligation. I have practiced ligation 17 times in 14 patients. In 9, both superior arteries were ligated; in 3, the right posterior; in 4, the left superior; and in 1, the left inferior. Five patients were operated upon twice and one three times, as follows:

First operation.	Second operation.	Third operation.
1. Ligation right superior thyroid.	Lobectomy.	
2. Right lobectomy.	Ligation left superior thyroid.	
3. Ligation both superior thyroids.	Ligation left inferior thyroid.	Right lobectomy.
4. Ligation both superior thyroids.	Right lobectomy and ligation of left superior pole.	
5. Ligation right superior thyroid.	Ligation of left superior thyroid.	
6. Ligation of both superior thyroids.	Right lobectomy and ligation of left superior pole.	

Last year I referred to Halstead's preference for the ligation of the inferior over the superior thyroid artery. I have recently done this several times because of the better cosmetic effect, but when this is not of importance I favor ligation of the superior thyroid because of the greater facility of including in the ligature not only the vessels, but the nerves, a technical point of which Crile has explained the

importance. C. H. Mayo<sup>1</sup> prefers ligation of the inferior thyroid artery in those patients suffering from a severer relapse after partial thyroidectomy.

C. H. Mayo<sup>2</sup> states that the majority of patients can withstand thyroidectomy at the time they are seen by the surgeon. Extreme conditions, especially dilatation of the heart, may require medical preparation, and the operative interference following in cases resistant to treatment should be confined to injections of boiling water into the gland after Porter's plan, to hasten improvement. In most of the severe cases, a ligation is made, first, of the left upper pole only. Should the reaction following this be severe, the ligation of the right upper pole is indicated a week later, and thyroidectomy reserved until four months have elapsed, by which time these patients have made an average gain of 22 pounds, with great general improvement. However, if the reaction following the left ligation is not unduly severe, a partial thyroidectomy may be made at the second operation the week following.

In the technique of ligation, C. H. Mayo<sup>3</sup> is careful to ligate, close to the tip of the thyroid gland to prevent reversal of circulation by vessel anastomosis.

There is nothing new about the operation of thyroidectomy although a paper has appeared by Jones,<sup>4</sup> in which it is urged that early ligation of the inferior thyroid artery should be done behind the carotid sheath and at a distance from the thyroid fascia in order to minimize hemorrhage. Petroff also advocates ligating the inferior thyroid artery before operating on the gland. He cautions against ligating both inferior thyroid arteries owing to the danger of injuring the nutrition of the parathyroids.

Sympathectomy for exophthalmic goitre has mostly been abandoned because of its inefficiency, but C. H. Mayo has revived the operation in certain cases of exophthalmic goitre. In numerous instances exophthalmos is the last of the symptoms to disappear, and often it causes much distress to patients who otherwise feel very well. In cases of hyperthyroidism in which the exophthalmos is extreme and the nervous symptoms out of proportion to the size of the thyroid, C. H. Mayo<sup>5</sup> advises the removal of the sympathetic ganglia and through the same incision ligation of the superior thyroid vessels. An incision is made in a natural crease in the neck opposite the bifurcation of the carotid. The sternomastoid is then drawn outward and the vessels inward, and the posterior sheath of fascia opened so as to keep the vagus nerve under observation, owing to its bulbous character at this point which might cause confusion with the lymphatic. The sympathetic is then found, the connective branches divided, the upper part of the ganglion

<sup>1</sup> *Surgery, Gynecology, and Obstetrics*, 1914, xix, 351.      <sup>2</sup> *Ibid.*, xviii, 322.

<sup>3</sup> *Ibid.*, xix, 351.

<sup>4</sup> *Ibid.*, 1913, xvii, 642.

<sup>5</sup> *Journal of American Medical Association*, 1914, lxiii, 1147.

torn off or cut, and the lower portions of the nerve cut or torn off at the middle ganglion until the middle ganglion is also removed. In such cases there is marked relaxation of the eye-ball and slight ptosis of the upper lid, with great general improvement of symptoms.

**DOUBLE RESECTION.** Diffuse colloid adenomas often offer a problem in technique because of the difficulty in obtaining a good cosmetic result and at the same time of removing the diseased thyroid. In such cases and in large goitres which have compressed the tracheal rings to the point of softening, Balfour's<sup>1</sup> modification of the Mickulicz resection is a valuable addition. After freeing the thin capsule of the gland in

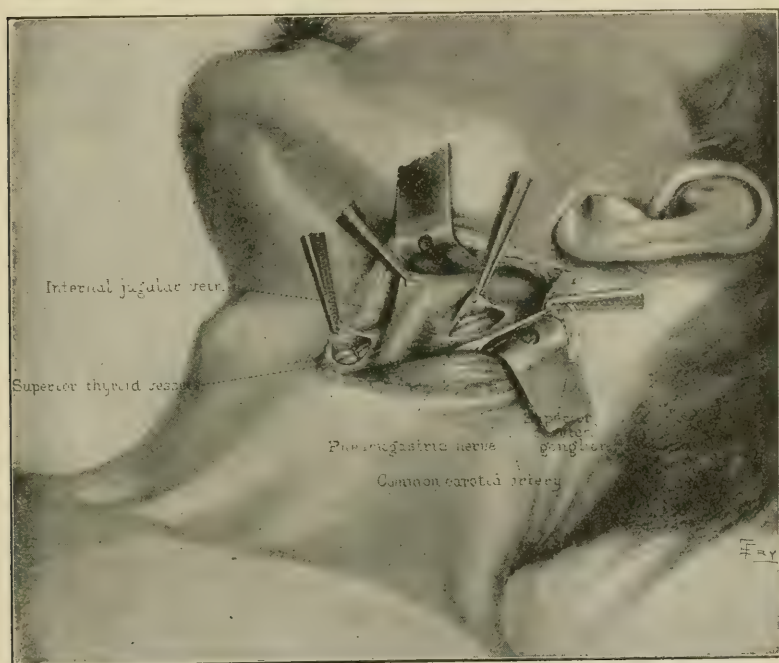


FIG. 5.—Shows incision into the sheath of the carotid vessels and exposure of pneumogastric nerve. Dissection of superior cervical ganglion and superior thyroid vessels ligated.

front, the gland is carefully explored to determine the size of the lobes, the relation of the trachea, and the presence of any substernal, retro-tracheal or other isolated portion of the gland. If both lobes are involved by a diffuse colloid condition or multiple adenomata of various sizes, the resection operation is indicated. Both lobes are dislocated, if possible, and then the isthmus is divided; following the division, the segment of the isthmus of one side is freed from any further attachment to the trachea and, by steady traction and careful dissection,

<sup>1</sup> *Annals of Surgery*, 1914, lix, 671.

the lobe on that side is freed from the trachea anteriorly and laterally sufficiently to relieve all pressure and to permit of satisfactory suturing

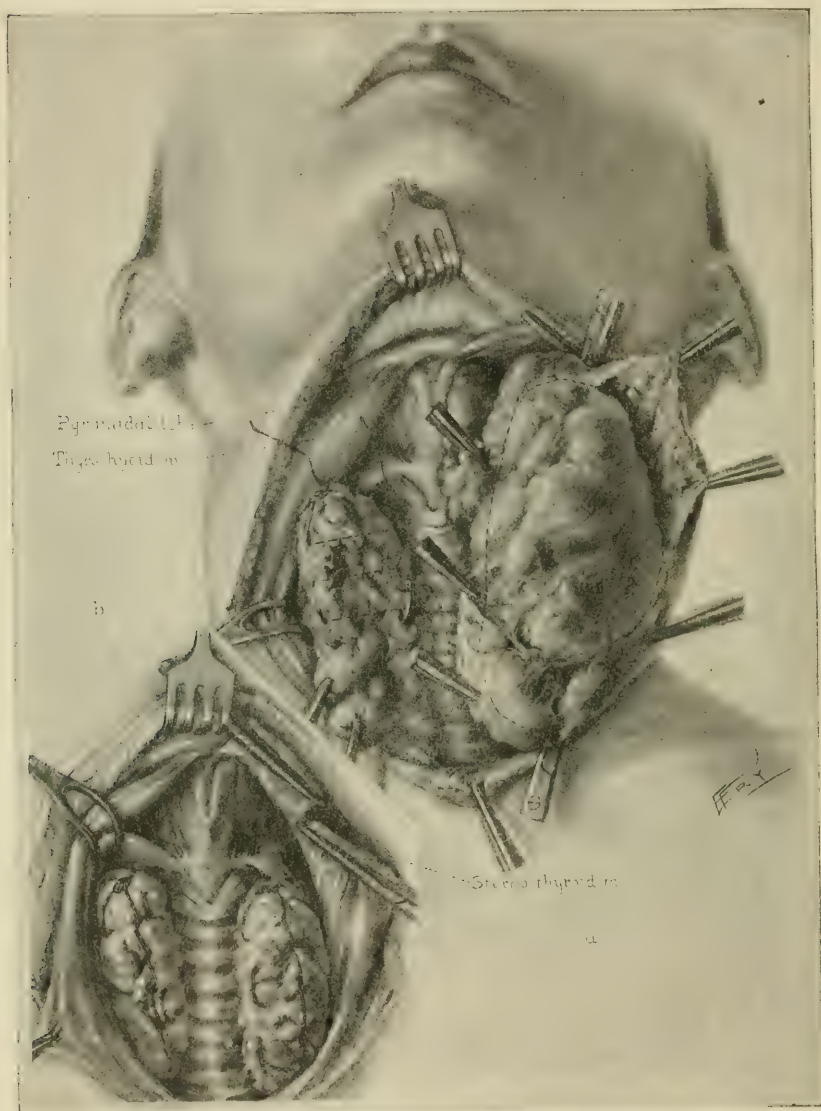


FIG. 6.—*a* (left lobe), shows controlling forceps placed and resection of lobe begun. Right lobe resected, with running mattress suture being placed; *b*, shows the relationship of the built-up remnants of the gland.

after the resection. The other half of the isthmus and the opposite lobe are freed in the same way. "Either lobe is now resected. A series of Ochsner forceps are applied somewhat as follows: One at the superior

pole, as a rule about an inch from the upper extremity, one at the inferior pole, three or four laterally, placed on the larger vessels in the capsule and two or three on the tracheal side. These forceps appropriately placed serve the joint purpose of marking the limitations of the resection and of enabling one to control hemorrhage by traction on them along with support of the lobe from behind with the finger. The lobe is then encircled with an incision through the capsule just above the forceps. The resection is then made by wedging out the interior of the gland. In practically all multiple adenomas, the colloid masses will separate easily from the healthy gland by finger enucleation. In the diffuse colloid glands without tumors, the proper portion to dissect is readily determined. Having completed this, there will be remaining the superior pole, the entire posterior capsule with a layer of gland tissue, and oftentimes the inferior pole, so that the portion of the gland most closely approaching the normal has been retained. This cup-shaped structure is now rebuilt into a compact strip of gland-tissue by suture. Starting at either pole, a continuous mattress suture of plain catgut from outer to inner capsule is inserted behind the line of forceps originally placed on the capsule and continued to the other extremity of the lobe. This controls practically all the bleeding and obliterates the cavity in the centre of the lobe. The same suture, returning in an opposite direction, by a locking or button-hole stitch catches the edge of the capsule and rolls the two edges together into some semblance of the normal lobe. This reconstructed lobe is then allowed to drop back into the space formerly occupied by the enlarged gland. The opposite side is treated in the same way, resecting as much as seems necessary."

It would serve no useful purpose to compare the results of medical treatment with surgical treatment. It suffices to state that the increased number of cases submitted to operation and the increasing confidence reposed in operative treatment would seem to justify the statement made earlier in these pages that exophthalmic goitre in its developed stage is a surgical and not a medical disease. In the pages of this periodical I have for a number of years given the results from not only prominent clinics but also from those who have had only a small number of cases, and with hardly an exception the results are exceedingly favorable. I have carefully studied all my own cases and present them in the following tables:

TABLE III.—FINAL RESULTS IN 37 CASES PRESENTING TOXIC SYMPTOMS WHICH HAVE BEEN RECENTLY HEARD FROM.

Pathological diagnosis.	Entirely well.	Greatly improved.	Moderately improved.	No improvement.	Total.
Non-hyperplastic-toxic (simple) . . . . .	2	1	2	..	5
Non-hyperplastic-toxic (adenoma) . . . . .	5	5	2	..	12
Hyperplastic-toxic . . . . .	5	7	1	..	13
Toxic cases in which ligation was performed . . . . .	3	3	1	..	7
Total . . . . .	15	16	6	..	37

TABLE IV.—SYMPTOMS IMPROVED SINCE OPERATION IN 30 CASES RECENTLY HEARD FROM.

Pathological diagnosis.	Mental irritability.	Palpitation	Ocular disturbance.	Weight.	Strength.	Diarrhea.	Dyspnea.
Non-hyperplastic-toxic (simple) . . . . .	4	2	..	4	4	..	3
Non-hyperplastic-toxic (adenoma) . . . . .	9	9	1	7	7	..	2
Hyperplastic-toxic . . . . .	11	9	10	10	10	4	7
Toxic cases in which ligation was performed . . . . .	4	3	4	4	4	4	3
Total . . . . .	28	23	15	25	25	8	15

The end results in the toxic cases were in accordance with those recorded from other clinics. Of the patients heard from, 90 per cent. had fully recovered, or were greatly improved, and, of the latter, a number had been operated within the last year. The completeness of the cure does not depend entirely upon the successful removal of the gland. Two other factors must be considered: First, the care of the patients after the operation, which should, whenever possible, free the patient from physical and nervous strain for periods varying from several months to two years. Unfortunately, the social status of the patient may make it impossible to provide these conditions sometimes. This must be borne in mind by the practitioner into whose hands the patient falls after operation, and the completeness of the recovery will depend upon his appreciation of the need of this after-treatment and whether the circumstances permit of its enforcement. Second, the existence of chronic visceral disease at the time of operation must be taken into account. Some of these patients are physical wrecks, with organic lesions of heart, kidney, and other organs, from which complete recovery is impossible.

I<sup>1</sup> have previously mentioned the work of Rogers and Beebe in the treatment of hyperthyroidism. In this last paper of Rogers,<sup>2</sup> he states

<sup>1</sup> PROGRESSIVE MEDICINE, March, 1912.

<sup>2</sup> Annals of Surgery, 1914, lx, 281.

that the use of antiserum was not satisfactory except in the early and uncomplicated cases of hyperthyroidism, and especially in the rare instances of early acute toxemic hyperthyroidism. In 208 cases he has performed ligation and division of one or more of the thyroid vessels, which must include the nerve supply of the gland, with four operative deaths and two deaths at remote periods of one and two years after the operation. Thirty-six patients were treated by quadruple ligation without death and without failures. Twenty-five consider themselves well, and lead normal and active lives, and two others who died suddenly from other causes were also considered cured. The remaining eleven presented more or less perceptible thyroid enlargement; nine of them showed some tachycardia after exertion or exercise, and two others showed a decreased, but still perceptible, exophthalmos. In other words, he has had 78 per cent. of practically perfect results, and no complete failures.

In regard to *organotherapy* he has the following to say: Adrenal, pancreas, ovary, thymus, pituitary or thyroid feeding have seemed helpful or necessary in about this order of frequency—thyroid feeding was beneficial in only two or three typical exophthalmic goitre cases who were subjected to the quadruple ligation and then was combined with adrenal feeding. Adrenal feeding is generally useful in those with a blood-pressure above 130 mm. of Hg. A combination of pancreas and adrenal feeding generally produces diarrhea, and these two organs seem incompatible. Pancreas feeding is usually helpful in cases with intestinal fermentation, especially when there is insomnia. Thymus or pituitary seems most helpful when there is a pronounced tendency to stoutness, and when asthenia is prominent. But no rules can be formulated, and the most helpful organotherapy must generally be ascertained by experiment.



# SURGERY OF THE THORAX, EXCLUDING DISEASES OF THE BREAST.

By GEORGE P. MÜLLER, M.D.

GREAT advances in the surgery of the thoracic cavity are slowly unfolding themselves. Intratracheal anesthesia and the development of the so-called "shockless operation" seem productive of a greater boldness in approaching the problems of the surgery of the chest than we have ever known in the past. Carrel<sup>1</sup> urges that the technical details must be more thoroughly worked out. Last year, in my discussion of esophageal cancer, I called attention to the various methods used to drain the pleural cavity, but Carrel insists upon the recognition of the greater liability of the pleura to infection, and that it must not be treated as is the peritoneal cavity. In his experimental work, he proved that intrathoracic operations may become as safe as operations on the abdominal cavity if a proper technique is followed. He uses pieces of Japanese silk and pads composed of cotton surrounded by Japanese silk. These are so placed, step by step, as to wall off the operative field and afford almost complete protection against infection from the air, and from the irritation produced by the handling of the serous membrane by the hands of the operator, sponging, and other operative traumatisms.

Werelius,<sup>2</sup> in writing on the experimental surgery of the heart, lung and trachea, also calls attention to the danger of infection; he uses the oiled Japanese silk formerly advocated by Carrel, and covers it with moist compresses. In reading about Carrel's patching of the pulmonary artery, cauterization of the valves of the heart, etc., and of Werelius' excision of the heart-sac, digital explorations of the ventricles, etc., we wonder what marvels the future has in store for us. Werelius found that cats without a heart-sac show very little, if any, disturbance, and if, at the end of an operation on the heart, the organ is acting poorly it is almost fatal to suture the heart-sac. For these reasons he suggests "that there is no doubt that some of the human heart-wound cases on whom operation is performed and which terminate fatally might have been saved had the pericardium been left open." Both of these papers will well repay a careful reading.

In another paper, Carrel<sup>3</sup> describes the operative technique of his

<sup>1</sup> *Surgery, Gynecology, and Obstetrics*, 1914, xix, 226.

<sup>2</sup> *Journal of American Medical Association*, 1914, lxiii, 1338.

<sup>3</sup> *Annals of Surgery*, 1914, lx, 1.

experiments on the orifices of the heart. They show how extensive a plastic operation on the heart can be made without danger to the life of the animal and suggest that some day surgeons will be able to cauterize valvular lesions, or to repair them, in the human subject. Another article of interest is that by Uffreduzzi,<sup>1</sup> many interesting experiments on the mediastinum being described.

Kummel<sup>2</sup> reports a most interesting case in which he operated on a ruptured thoracic aortic aneurysm. The aorta was explored by resecting five ribs posteriorly and by cutting downward through the diaphragm. The exposure was made without opening the pleura or peritoneum. Blood clots were removed and the sac cut away, with the circulation controlled by compression of the aorta by the hand of an assistant. The opening in the aorta was closed by suture. Circulation in both limbs was restored; at the close of operation the pulse was good. He died a few hours later of cardiac weakness.

It is evident therefore that the surgery of the heart and great vessels is gradually being developed, and that great advances may be expected in the near future.

A number of papers have appeared bearing on intratracheal anesthesia, and the method is finding favor not only here but abroad. I have continued to use the apparatus described last year and can only again emphasize its usefulness, not only in the surgery of the thorax, but also in operations on the head, face and neck, and especially in laminectomy where the patient assumes the prone position. Meltzer<sup>3</sup> calls attention to one practical point. To be sure that the tube is in the trachea and not in the esophagus, it is necessary to push the catheter downward until it encounters undoubted resistance, usually about 33 cm. from the incisor teeth; if it can be pushed more than 1 to 2 cm. farther, it is in the esophagus. He states that "the practice of inserting the tube only to a place above the bifurcation must be discontinued." We have had no trouble whatever since I insisted on visual insertion of the tube through the Jackson speculum. The vocal cords are distinctly seen and the catheter dropped through them. I also agree with him in condemning the common practice of pharyngeal etherization; infectious material is more apt thereby to be driven into the lungs than by the drop method. The surgery of the lungs has made much progress but I will save the material until next year and review it more completely, contenting myself with a more comprehensive review of the suppurative conditions of the lungs and pleura.

**Bronchiectasis.** To no one class of patients has the modern advance in intrathoracic surgery been of more importance than to those the victims of bronchiectasis. As Mumford and Robinson<sup>4</sup> picturesquely

<sup>1</sup> Polielinico, 1914, xxi, 13.

<sup>2</sup> Annals of Surgery, 1914, lx, 116.

<sup>3</sup> Journal of American Medical Association, 1914, lxii, 1547.

<sup>4</sup> Annals of Surgery, 1914, lx, 29.

state, "our interest in bronchiectasis results from a desire to relieve a disgusting and disabling malady; to restore to efficiency a chronic invalid; and to reinstate among society an individual ostracized by the ever present accumulation of a profuse and generally offensive expectoration." Nothing remarkable has as yet been done, but greater hope can now be held out to those unfortunate individuals than has been done in the past by the combined efforts of various specialists.

At the meeting of the Americal Surgical Association in 1914, three papers were read on this subject, one of which has just been mentioned. Another paper was read by Willy Meyer<sup>1</sup> and it is the first exhaustive treatise on bronchiectasis in the English language. Bronchiectasis is a disease of the bronchial tree, not of the pulmonary parenchyma. Mosler, in 1873, was the first to propose the incision and draining of a bronchiectatic cavity; now we know that such a cavity should almost never be drained, hence the importance of a careful differentiation between this condition and lung abscess, a confusion which practitioners often make.

Concerning the pathology, we should bear in mind that the diffuse variety is of pathological interest only, except perhaps in those cases occurring in children with inherited syphilis. Milhit<sup>2</sup> reports the cases of three children of ten to thirteen, who had pronounced signs of bronchiectasia and a positive Wassermann reaction. Under syphilitic treatment, all the physical signs and general symptoms of both the bronchiectasis and the lues entirely disappeared. That the circumscribed variety may be either single or multiple should also be remembered. This is of importance when considering surgical interference, as is well shown by Batzdorff.<sup>3</sup> In 53 cases of pneumotomy, a cure was real in only 9.4 per cent., while 62 per cent. died. The principal reason for this unfavorable result was that the bronchiectasis was multiple; with numerous foci, it is impossible to reach them all and operative treatment is of little use. The circumscribed variety is fortunately the one commonly met with clinically, and is found most frequently in the lower lobes of the lungs on either side, as was the case in 40 out of 45 of Tuffier's cases (quoted by Meyer), although it is sometimes found in the middle lobe of the right lung. In the congenital form, which is uncommon and not of surgical interest, the whole lung is usually involved, presenting many small cysts filled with a watery or mucoid fluid. This is not necessarily fatal, as patients with this condition have been known to live as long as sixty-five years. Both lungs, of course, may be the seat of the disease at the same time. There are no age features as to incidence, but males are more subject than females. The exact mechanism of its production is still a matter of discussion.

<sup>1</sup> *Annals of Surgery*, 1914, lx, 7.

<sup>2</sup> *Archiv. de Méd. des Enfants*, Paris, 1914, xvii, p. 105.

<sup>3</sup> *Centralbl. für die Grenzgeb. der Med. u. Chir.*, 1912, xvi, p. 1.

Most writers consider some form of chronic inflammation as the most frequent cause of acquired bronchiectasis. Meyer discusses the etiology, and I find another paper by Howard<sup>1</sup> which discusses the etiology and pathogenesis of bronchiectasis in a very complete manner and should be read in the original to be appreciated. He mentions acute and chronic bronchitis, bronchial stenosis and bronchial obstruction, pulmonary changes, such as collapse, pneumonia, emphysema, and fibrosis. Howard quotes from Hoffman as stating that foreign bodies are too little considered in the etiology of bronchiectasis, and from Jackson as urging the importance of considering each case of bronchiectasis as a possible foreign body. Knopfmacher<sup>2</sup> reports a case in which the presence of a foreign body in the bronchus, unrecognized for years, was the factor in producing a typical bronchiectatic cavity. Braxton Hicks<sup>3</sup> has reported an intrabronchial sarcoma causing bronchiectasis. The pathogenesis is considered at length by Howard, and in this connection I would call attention to Ewart's explanation that the common feature of all cases of bronchiectasis is faulty distribution of space between the air tubes and pulmonary tissue. In general, patients with bronchiectasis do not feel very sick; at first the clinical symptoms are insignificant, and the cough and purulent expectoration is taken for a pharyngeal or bronchial catarrh. The admixture of blood, together with a foul odor and taste, first bring the patient to consult his physician. The preponderating symptom is an abundance of sputum which, accompanied by paroxysmal attacks of coughing attendant upon a change in position, often fills the mouth of the patient faster than he can get rid of it. Serious hemoptysis is frequent, but seldom fatal. The foulness of the odor of the sputum often renders these patients a burden to themselves and family, and, although tubercle bacilli are never demonstrated in the sputum, the close similarity of symptoms often confuses the diagnosis, and these patients are frequently found in sanatoria for consumptives. The diagnosis is not easy, but continued observation will gradually reveal the true condition, chiefly by "the exclusion of allied diseases, by the etiology, by the history of repeated winter colds resembling broncho-pneumonia, by the nature, persistence and quantity of the sputum, and by the presence of influenza bacilli." (Mumford and Robinson.) Auscultation and other physical signs can only be regarded as confirmative. In order to make the radiograph of more value in showing the true condition, Meyer suggests the insufflation of collargol into the depth of the trachea and bronchi after the patient has thoroughly expectorated. This may perhaps show more distinctly the contours of the walls of the distended bronchial cavities, the same as in pyelography.

<sup>1</sup> American Journal of the Medical Sciences, 1914, cxlvii, 313.

<sup>2</sup> Münch. med. Woch., 1912, vol. lix, p. 1132.

<sup>3</sup> Lancet, 1914, i, 1386.

Bronchiectasis is a chronic disease, death being most often due to the complications. Of these complications, brain abscess is startlingly frequent; abscess of the cord, and very acute suppurative meningitis may also occur. Tuffier (quoted by Meyer) lost 6 out of 45 cases from brain abscesses. Meyer had 3 cases of acute suppurative meningitis in his 10 cases. Meyer quotes Aschoff in explaining this peculiar complication, "We only know that the bronchial secretion contains myelin substance in abundance; bronchial and alveolar epithelium have the tendency to produce myelin of a special kind, as has been shown by Virchow. It might be possible that, in consequence of this, the microorganisms of the bronchial secretions, whenever they enter the circulation, gain a predilection for the central nervous system which is so rich in myelin. On the other hand, it may be that the cord and brain become infected by way of the lymphatics." Other causes of death have been pneumonia, gangrene, hemorrhage (rarely), general sepsis, and general degeneration of the parenchymatous organs from long continued suppuration. Perforation into the pleural cavity, with resulting pyopneumothorax, has in every case been fatal.

TREATMENT. I might open the discussion of this paragraph by a quotation from Robinson:<sup>1</sup> "I wish that I could proclaim some brilliant surgical successes in bronchiectasis, but I cannot, except in one case. Is it not true, however, that many general operations successful today would have remained in their undeveloped infancy had not the faith of certain internists been greater than the surgical results justified at the time? Those of us who are struggling with the surgery of chronic lung infections wish only to convince physicians that we are conservative; that we are not inclined to attack unsuitable cases; that we are working along channels of surgical propriety; that already we can relieve, and that eventually, with added experiences, we may cure some of these bronchiectatic cases which seem to defy medication."

Meyer believes that bronchiectasis is a surgical and not a medical disease, particularly in the advanced cases. He states that, "at the present time, in early cases, the treatment should be carried out progressively, *i. e.*, beginning with milder measures, carefully observing their effect, and, if unavailing, resorting to one of the various intrathoracic operations devised. In advanced cases the latter have to be considered from the start. The only drawback at the present moment is the difficulty in selecting an operation which is effective and does not involve too great a risk, for it will have to be the surgeon's first task to show a low mortality in these operations. Only in this way can the absolutely necessary confidence of profession and laity in thoracic work be gained, and wholesome progress be guaranteed. Briefly reviewing

<sup>1</sup> Pennsylvania Medical Journal, 1913, vol. xvi, p. 527.

what is known to us in the way of useful, active therapy in bronchiectasis today, one may classify as follows:

### I. Non-operative Treatment:

(a) By way of the alimentary canal—thirst cure.  
 (b) By way of the circulatory system—intravenous injection of colloidal silver.

(c) By way of the respiratory system—(1) inhalation of superheated air with admixture of suitable drugs; (2) direct intrabronchial application of drugs by syringe or spray.

### II. Operative Treatment:

(a) Extrapleural—(1) thoracoplasty; (2) pneumolysis.  
 (b) Intrapleural—(1) therapeutic pneumothorax—insufflation of nitrogen; (2) incision of the lung—pneumotomy; (3) transposition of lung by means of suture fixation; (4) ligation of branches of pulmonary artery; (5) extirpation of the diseased portion of the lung.

(c) Intrapericardial ligation of either main branch of the pulmonary artery (still in experimental stage).

(d) Diaphragmatic—paralyzing one side of the diaphragm corresponding to the diseased lung by resection of the phrenic nerve at the neck (phrenicotomy).

The operative treatment should also be considered from the following points of view:

A. Pneumotomy for draining the suppurating cavities.

B. Operations done to compress the lung (collapse-therapy).

(1) By creating therapeutic pneumothorax—nitrogen insufflation; (2) pneumolysis with or without introduction of a plomb; (3) thoracoplasty, combined with or without (4) phrenicotomy.

C. Operations done to influence pulmonary parenchyma, producing contraction plus carnification. (1) Transposition of the lung; (2) ligation of branches of the pulmonary artery, with or without subsequent thoracoplasty, pneumolysis and phrenicotomy—intrapericardial ligation of the first divisions of the pulmonary artery.

D. Amputation of the diseased lung.

I will not discuss the non-operative treatment. It is given in detail in Meyer's monograph. In the preparation of the patient for operation, he advises that a posture which favors emptying of the bronchial cavity should be adopted for a few days before operation. Regional or local anesthesia are preferable to general anesthesia; if differential pressure is used, negative pressure is to be preferred, but he evidently does not favor the intratracheal insufflation method, believing it best for patients to have the mouth free and unencumbered in order that they may expectorate. If we glance at the table of operations previously mentioned, we notice that drainage is mentioned first. Meyer states that this operation is indicated as the first step only in the draining of one large bronchiectatic cavity. In exceptional cases pneumotomy may

be indicated, in spite of a more diffuse infection, because prompt free drainage of the bronchial tree reduces the intrabronchial putrefaction. Mumford and Robinson state that the first indication in therapy should be the removal of any bronchial obstruction, such as foreign body, tumor, or disease. They condemn the drainage operation as being inadequate.

Operations performed for the purpose of compressing the lung are next mentioned. Meyer does not think that artificial pneumothorax can be recommended as a means of cure or even of permanent improvement in somewhat advanced cases of bronchiectasis. Mumford and Robinson, on the other hand, state that artificial pneumothorax should generally be attempted in bronchiectasis especially in the early stages, and Zinn<sup>1</sup> reports 3 cases which encourage the hope that this method may have a future, especially if done before the tissues have become hopelessly rigid. Artificial pneumothorax is, of course, impossible when the pleural surfaces are extensively adherent, and, in these cases, surgeons have resorted to pneumolysis with the introduction of a plomb, thoracoplasty, the pleuro-pneumolysis of Friedrich, or phrenicotomy. The operation of phrenicotomy is the most interesting of these and is based on the principle that the dome of the unilaterally paralyzed diaphragmatic muscle rises up to the second or third rib, and this compresses the lung from below. Robinson<sup>2</sup> has published his experience with 3 cases treated by pleuro-pneumolysis. The first died in two weeks from a subdiaphragmatic abscess and septic spleen on the opposite side to the lesion. The second case was greatly improved for a time, but, six months later, the quantity of sputum was the same as prior to operation and the patient was in no way improved. The third patient died three days after the operation with respiratory embarrassment due to impaired function of the unoperated chest by oscillation of the mediastinum caused by the absence of the rigid chest wall. Atrophy of the affected lung tissue and its carnification has been obtained in many ingenious ways, by ligation of the branch of the pulmonary artery that carries blood to the affected lung, for aëration, thus producing atrophy by abolishment of functional activity, and by the intrapericardial ligation of the first divisions of the pulmonary artery. The latter method was proposed by Meyer<sup>3</sup> to overcome the technical difficulties encountered in the former procedure.

Recently, Henschen<sup>4</sup> proposed the bringing of the lower lobe under the diaphragm in order to attain as great contraction as possible from compression, but the fourth method of surgical attack is the one which has been regarded as the most promising, that of lung resection. It is

<sup>1</sup> *Therap. d. Gegenw.*, 1914, lv, 337.

<sup>2</sup> *Boston Medical and Surgical Journal*, 1911, clxv, 398.

<sup>3</sup> *Annals of Surgery*, 1913, lvii.

<sup>4</sup> *Beit. z. klin. Chir.*, 1914, xc, 373.

an operation of some magnitude, and Meyer summarizes the dangers as follows: "First, the vagus reflexes in handling the bronchus near the hilus; second, the possible strong adhesions in this region when the disease has been of long standing; third, the tendency of the bronchial stump to slip back when no adhesions are present; and fourth, the deadly 'pressure pneumothorax' if the pleural cavity was thoroughly closed after the extirpation, but the occluded bronchial stump leaks." It is generally conceded that the one-stage operation in lung resection, in the light of our present knowledge, is not justified, but that preliminary retraction of the diseased lung should first be obtained by some of the other means discussed—artificial pneumothorax, thoracoplasty, or pulmonary ligation. "This allows the patient to accommodate himself to the changed conditions of breathing and circulation before undergoing the added insult of lung amputation." Mumford and Robinson<sup>1</sup> point out the complications likely to follow the one-stage operation, "postoperative pneumothorax is today more threatening to life than the operative pneumothorax, the dangers of which latter we have learned to overcome by apparatus. As to postoperative pneumothorax, on the other hand, the presence of air in the pleural cavity following lung resection leads to the accumulation of fluid; pneumothorax becomes hydropneumothorax. In the presence of a bacteremia as a result of the previous infection, this fluid may become infected, or the cavity may have been infected at the time of operation. Such a subsequent infection interferes with the healing of the stump. The remaining lobes of the lung on the diseased side are restricted in function. There is a tendency to incomplete oxygenation of the blood. The lung on the sound side is suddenly burdened with compensatory function. The pulmonary circulation is disturbed. The right heart is overworked." Meyer believes that his method of treating the bronchial stump, in his experimental work, will prove a safe procedure in making the bronchus air-tight in man, if isolation and ligation of the vessels is feasible as it will be in favorable cases where the disease is confined to one lobe and pleural adhesions are few. His method consists in the crushing of the bronchial cartilages with a strong clamp, as Doyen's intestinal crusher, with inversion of the tied stump and a number of top sutures. Wydler<sup>2</sup> has carried out resection of the lobe of the lung with almost a complete cure. As the opposite lung was also affected, cure was not complete. Robinson<sup>3</sup> has excised the left lower lobe in two stages with cure. Meyer, in 16 cases collected by him, found that in 7 which were done in the presence of far-reaching adhesions, there were 6 recoveries and 1 death; 3 were done without the presence of adhesions, with 1 recovery and 2 deaths; in 6 where no

<sup>1</sup> Loc. cit.

<sup>2</sup> Mitt. a. d. Grenzgeb. der. Med. und. Chir., 1914, xviii.

<sup>3</sup> Loc. cit.

statement was made as to adhesions, there was 1 recovery and 5 deaths.

**Lung Abscess and Gangrene.** Many cases of lung abscess are reported in the literature, and some advance has been made in their recognition and treatment, but, generally speaking, the treatment of abscess and gangrene of the lung is not particularly satisfactory. Most of the writers agree with Tuffier that it is difficult to distinguish between acute gangrene and abscess of the lung. A lesion beginning as an abscess may later develop into gangrene, or a case starting as gangrene may, by partial obstruction of the diseased area and subsequent infection, be converted into an abscess cavity. The only paper devoted distinctly to abscess and gangrene of the lung is written by Walker.<sup>1</sup> He only discusses the acute abscesses, and in a series of cases none have been reported in which the condition is not absolutely known to have been acute. I would again call attention this year to the excellent monograph of Garre and Quincke in which pulmonary suppurations are fully considered.

The *etiology* of abscess and gangrene is identical; a lowered vitality of the individual and a lowered local vitality of the lung are the important predisposing factors. Pneumonia, embolism, foreign bodies, immersion, inhalation of pus, vomitus or irritating gases, penetrating wounds, contusions, tumors, and empyema are the causes producing a lowered tissue resistance. Whittemore<sup>2</sup> reports 2 cases of abscess of the lung following immediately after taking ether. One patient had been operated on for a deviated septum and the other had had several teeth extracted. Both cases recovered and remained well.

I operated on a patient with abscess of the lung, in Dr. Frazier's service in the University Hospital last year, who developed an abscess of the lung following a gun-shot wound of the chest. Otitis media, puerperal infections of the uterus and phlebitis of the lower extremities are most apt to be the starting point of embolic pulmonary abscess. It sometimes follows operations on the stomach, but, as a rule, these emboli are not septic. Walker quotes elaborate statistics from the literature showing the incidence of abscess and gangrene in the cases gathered by him. Pneumonia caused acute abscess or gangrene of the lung 97 times in 147 cases (66 per cent.); in 25 cases the cause was not given. A third way in which abscess may result is by extension through the lymphatic vessels or directly from the liver. Pulmonary complication of liver abscess has been recently discussed by Thompson.<sup>3</sup> He reports 27 cases of liver abscess in which the lung and pleural cavity was infected in 11 (40.8 per cent.). Walker shows that males are more predisposed to abscess and gangrene in the proportion of

<sup>1</sup> Boston Medical and Surgical Journal, 1914, clxxi, 49.

<sup>2</sup> Ibid., clxx, 376.

<sup>3</sup> Annals of Surgery, 1914, lix, 891.

three to one, and, although the disease is one of adult life, the average age being 31.6 years, it was found as early as two months.

Acute abscess is generally found in the base of the left lung, and usually 3 or 4 cm. from the surface. If the abscess is due to the inhalation of a foreign body, the cavity is more likely to be in the lower lobe of the right lung. The lesion is usually single, excepting those embolic in origin and those following influenzal pneumonia. As the abscess enlarges, it tends to rupture into a bronchus or into the pleural cavity although empyema is often prevented by the formation of adhesions between the two layers of the pleura. Gangrene is found most commonly in the lower lobe of the right lung near the surface, and it differs from abscess in the predominance of putrefactive organisms, whereas in abscess pyogenic organisms predominate.

Walker states that the accurate *diagnosis* of acute abscess and gangrene of the lung may at times be easy and at other times almost impossible. They should be distinguished from each other and from bronchiectasis, putrid bronchitis, rupture of an empyema into the lung, putrefactive changes in the walls and contents of a tuberculous cavity, and empyema. *Echinococcus* cyst and liver abscess which has ruptured into the lung should not be overlooked. The history is of the utmost importance; the duration of the process should be ascertained; the clinical chart should be examined for the type of temperature and for the respiratory rate; and the state of the chest determined by percussion and auscultation. Walker states that an *x-ray* examination of the chest should, if possible, be made in every suspected case of lung abscess or gangrene as it will locate more exactly an abscess or gangrene than any other means of diagnosis. He cautions, however, that the interpretation of the plates should be made only by the skilled röntgenologist. Lilienthal,<sup>1</sup> however, states that the misreading of the *x-ray* plates is an old story and nowhere can one be misled more easily than in the diagnosis of intrathoracic conditions. Mumford and Robinson<sup>2</sup> believe that "when all signs and symptoms are confusion and suggest too many interpretations and we rush to the *x-ray* specialist, he cannot differentiate for us. He will demonstrate any or all of the complex of signs that the stethoscope has prophesied, but he is of little consolation in our dilemma."

They remark this in discussing bronchiectasis, but it seems to me to be just as applicable to abscess. Pirie<sup>3</sup> reports 5 cases examined by the *x-ray* and he states that an abscess of the lung partly filled with pus and partly with gas can be diagnosed by the *x-ray*. When examined, the patient must be in the erect position, and the horizontal ray must pass through the upper level of the pus in the abscess cavity. He gives a detailed description of the method to be pursued by the röntgenologist

<sup>1</sup> *Annals of Surgery*, 1914, lix, 855.

<sup>2</sup> *Ibid.*, 1, 29.

<sup>3</sup> *Surgery, Gynecology, and Obstetrics*, 1914, xix, 549.

in order to avoid failure. Examination of the sputum should always be made macroscopically and microscopically, and its characteristic appearance in abscess and gangrene is well known.

Finally, in regard to needle puncture, some writers advise against this method of diagnosis in the fear that the healthy pleura will be infected; others advise its cautious use. Walker states that if the needle is used, it should be made to enter the skin at about the centre of dulness, and, if pus is not found at the first puncture, the needle should be withdrawn into the pleural cavity and again made to perforate the lung in one or more directions. If pus is located, the needle should be left in place until operation, or careful note taken of the point at which the needle pierced the skin and the direction it took on entering the lung. If diagnosis can be made in any other way, exploratory puncture should not be used.

While a serious disease, the *prognosis* of lung abscess or gangrene depends upon the cause, size, and number of abscesses, the length of time present, and the virility of the organism. The prognosis in abscess is more favorable than in gangrene, and statistics show that a larger per cent. of both recover with surgical than with medical treatment. Gangrene treated medically has a mortality of 80 per cent., while according to Eisendrath it is but 22 per cent. under surgical treatment. In Walker's review, the mortality in acute abscess under surgical treatment is 25 per cent., that in gangrene 44 per cent.

Although many cases of abscess will heal spontaneously, continued expectant *treatment* may be carried too far and result in purulent empyema. Drainage of such empyemata in the presence of an abscess is attended by a high mortality, while the mortality of uncomplicated acute abscess under surgical treatment should not be over 8 per cent. As to the division of responsibility between internist and surgeon, Robinson<sup>1</sup> says, "The internist should transfer the responsibility of the case to the surgeon, even though he is unable to definitely localize the seat of the abscess either by physical examination or by exploratory needle puncture. This localization is not always possible, even though the presence of a suppurative process is unquestionable. The surgeon will seek the help of the internist as to the area most probably involved, but the finding of the abscess becomes his duty and not that of the internist."

Certain cases are unquestionably medical, as diffuse forms of gangrene and bilateral abscess. Medical treatment aims at evacuation of the abscess cavity, combined with tonic treatment of the individual. Jacobs<sup>2</sup> reports the cure of a patient treated with *vaccines* and is enthusiastic as to their value. Certainly vaccines properly administered may serve to reduce the high mortality. Surgery, however, should be

<sup>1</sup> Boston Medical and Surgical Journal, 1911, clxv, 398.

<sup>2</sup> Cleveland Medical Journal, 1910, ix, 946.

advised if the gangrene is not diffuse; if an abscess is unilateral, or, at most, if deep lesions do not exist on both sides, when the patient is still in a condition to stand operation, and when the site of the lesion is determined.

Murphy<sup>1</sup> reports 2 cases operated upon under local anesthesia, and considers the *choice of anesthetic* in operating for abscess of the lung. Local anesthesia, with or without morphine or scopolamine, with one of the less toxic drugs, as novocain, avoids entirely the dangers attendant upon the use of a general anesthetic in these conditions, and is therefore the method of choice except in children and when the abscess cannot be definitely located previous to operating. If a general anesthesia is necessary, nitrous oxide with oxygen is the ideal one in cases of lung infection. The mixture is not irritating to the respiratory tract and the anesthesia may be carried out to the satisfaction of the operator, and yet be of such a light degree that the protective reflexes of the trachea are only temporarily abolished. Murphy states that by the use of the intratracheal tube the accumulation of foreign material in the trachea is prevented, thereby lessening the danger of further infection of the lung. Lilienthal<sup>2</sup> also states that differential pressure, however attained, is a valuable aid in chest surgery. But it must be understood that most of the common operations on one lung can be done under anesthesia managed in the ordinary way. Walker states that, in acute cases, intratracheal insufflation of ether is not deemed advisable because of the danger of spreading pus into some uninfected area. One need not fear collapse of the lung, since pleural adhesions are present in most cases.

The *technique of the operation* varies greatly with the individual surgeon as well as with the particular case. The incision should be made and the ribs removed from the area where pus is diagnosed whether that be anterior, lateral, or posterior. If the pus is known to be near the surface, it will be sufficient to resect a portion of one or two ribs, but if there is doubt as to the exact location, an opening must be made large enough to admit the hand for exploration. The opening in the pleura should be small at first and air allowed to enter slowly, and, if respiratory difficulty takes place, the opening may be temporarily closed with gauze. Pleural adhesions will be found present in about 53 per cent. of cases. Their presence prevents lung collapse, but they may also hide a neighboring pleural abscess which should not be overlooked. The danger of opening an abscess in the absence of adhesions is, of course, pneumothorax and pleural infection. If the condition of the patient is such that he can tolerate the presence of pus a few days longer, it is better to divide the operation into two stages and wait until a barrier of adhesions has formed. If, on the

<sup>1</sup> Annals of Surgery, 1914, lx, 36.

<sup>2</sup> Loc. cit.

other hand, the toxemia is so profound that a delay of some days would endanger the patient's life, one should not hesitate to open the abscess at once, using all precautions to prevent the spread of infection, either by uniting the two layers of pleura by stitch, or by packing gauze between them so that the pleural cavity is shut off from the abscess. If done in two stages, the second operation should be done in from three to five days. Lilienthal also advises the two-stage operation in certain cases, but believes that when resection of the diseased lung is contemplated, a one-sitting operation is best. Robinson,<sup>1</sup> after excising the ribs and ligating the intercostal vessels, divides the posterior periosteum and connective tissue in one layer, thus exposing the parietal pleura. This is continued until the line of demarcation between the normal and thickened pleura is reached, at which place a hemostat is pushed through the latter into the abscess cavity. After the abscess cavity is opened, care should be taken not to break any firm bands felt in the cavity as they may be vessels. Lavage of the cavity should not be practiced. The cavity should then be drained without great compression. Some surgeons use iodoform gauze and some condemn its use. The cautery may, of course, be used in opening the lung. Complications that may occur during the operation are many, but their occurrence is rare. The abscess may burst into a bronchus, there may be sudden asphyxia due to pneumothorax from too large an initial opening into the pleura, and syncope of reflex origin and a sort of tremor or convulsion of the lungs (*lungenflattern*) may occur.

Empyema, secondary lung abscess due to poor drainage, hemorrhage, septicemia, and pyemia are factors which may complicate convalescence. In the 132 cases of acute abscess collected by Walker, adhesions were present at the time of operation in 63, they were absent in 2 and not mentioned in the others. In the 40 cases of acute gangrene, they were present in 17, and not mentioned in 23. The mortality in the acute abscess cases under medical treatment was 54 per cent.; under surgical treatment, 25 per cent. In the cases of acute gangrene treated medically, the deaths were 89 per cent., while under surgical treatment death occurred in but 44 per cent.

**Empyema.** Although there is little that is new about thoracic empyema, I have thought it worth while to review a number of the more important articles. Dunlop<sup>2</sup> has contributed a very complete study based upon 98 cases of empyema treated in the Royal Hospital for Sick Children, Edinburgh. The pleural fluid effused during childhood appears to have a marked tendency to be of a purulent character, and the younger the child, the more pronounced does this tendency become. In 59 cases of empyema in children under three, the fluid

<sup>1</sup> Boston Medical and Surgical Journal, 1911, clxv, p. 398.

<sup>2</sup> Edinburgh Medical Journal, 1914, xiii, p. 4.

was purulent in 53, and in the other 6 it was either serum or turbid serum.

Under 6 months	3 cases, all purulent,							
Between 6 months and 1 year	9	"	8	"	1 serous			
" 1 year	"	2 years	26	"	24	"	2	"
" 2 years	"	3	"	21	"	18	"	3
" 3	"	"	5	"	23	"	18	"
" 5	"	"	10	"	57	"	27	"
over 10	"	10	"	1	"	9	"	

**BACTERIOLOGY.** The fluid drawn off was invariably submitted to a bacteriological examination, and the results obtained are very similar to those of other observers.

The pneumococcus was present in pure culture in 53 per cent. of all cases. When the pneumococcus is accountable for the effusion, the pus is opaque and greenish in color, of a thick, creamy consistency, and generally associated with large masses of fibrin.

Next in order comes streptococcal infection, which was present in 16 per cent. In such cases the pus was much thinner in character, and frequently on standing gave a whitish-gray deposit. In 14 per cent. the culture showed a mixed infection of streptococcus and pneumococcus. When this occurred the pus was often thin and watery at first, but became thicker later, owing to the pneumococcal infection. The staphylococcus alone was present in 3 per cent., and in 2 of the cases where it was found, the pus had an offensive odor. The tubercle bacillus occurred in 3 per cent., while other forms and no growths occurred in 6 per cent. of the cases. The tubercle bacillus being difficult to find, it may have been present in some of the cases where no growth was found; the fluid in the majority of these cases was of a turbid character.

The results are depicted in the accompanying table: In 53 cases the pneumococcus was present alone, in 16 cases the streptococcus was present alone, in 14 cases the pneumococcus and streptococcus were present mixed, in 3 cases the staphylococcus was present alone, in 1 case the staphylococcus and pneumococcus were present mixed, in 2 cases the staphylococcus, streptococcus and pneumococcus were present mixed, in 3 cases the tubercle bacillus was present alone, and in 6 cases no growths were present.

Werner,<sup>1</sup> in reporting 178 cases treated in the Children's Hospital at Riga during the years 1900 to 1911, reports the following results of bacteriologic studies as compared with the mortality. The tuberculous group was excluded.

	Cases.	Cured.	Died.	Mortality.
Pneumococci . . . . .	58	43	15	25.9 per cent.
Streptococci . . . . .	35	31	4	11.4 "
Staphylococci . . . . .	13	11	2	15.4 "
Influenza bacillus . . . . .	1	..	1	100.0 "
Mixed infection . . . . .	26	19	7	26.9 "

<sup>1</sup> Deutsche Zeit. f. Chir., 1913, cxxiv, 419.

Hirano<sup>1</sup> studied 118 cases of empyema operated on in a hospital in Japan during 1900 to 1911. In these, the pneumococcus in 40 per cent., the staphylococcus in 13 per cent., and the streptococcus were the organisms most frequently found. In 32 per cent. of the cases, the pus was sterile. Eighty per cent. of these cases occurred in children. The statistics of Werner are slightly at variance with those usually published and I was glad to see them because so many writers refer to the comparative mildness of pneumococci infections and advocate simple aspiration for their treatment. The mortality of empyema is very high, and if more attention was paid to diagnosis and prompt operative treatment than to studies of the character of the pus, the results would be infinitely better.

ORIGIN. Dunlop admits the possibility of a primary form due either to cold or injury but believes that, in the majority of cases, the empyema is secondary, and in only 7 per cent. of his cases did he fail to get a history of some lung or other antecedent trouble. The effusion rarely follows bronchopneumonia, and the etiology is well set forth in the following table:

Lobar pneumonia . . . . .	69 per cent.
Infectious diseases . . . . .	11 "
Bronchopneumonia . . . . .	5 "
Suppurative processes . . . . .	3 "
Tubercle . . . . .	3 "
Influenza . . . . .	2 "
Causes unknown . . . . .	7 "

Werner compares the predisposing cause with the mortality:

	Cases.	Cured.	Died.	Mortality.
Pneumonia . . . . .	71	56	15	21.1 per cent.
Scarlet fever . . . . .	39	24	15	38.5 "
Measles . . . . .	6	4	2	33.3 "
Pertussis . . . . .	1	1	0	
Causes unknown . . . . .	61	54	7	11.5 "

CLINICAL ASPECTS. There is of course nothing new to report in the methods of diagnosis in empyema except to insist upon the necessity for early diagnosis. As Robinson<sup>2</sup> well says, "no case of pneumonia should be regarded as properly treated in which, in the process of resolution, one is not constantly watching the temperature, physical signs and leukocytosis for the possible accumulation of serous or purulent fluid." Robinson also states that though convinced that pus is present in the chest, we are often guilty of lack of diligence in its pursuit. It should also be remembered that abscess of the liver, subdiaphragmatic abscess, and perforated duodenal ulcer are not infrequently complicated by

<sup>1</sup> Deutsche Zeit. f. Chir., 1913, cxxiv, 507.

<sup>2</sup> Boston Medical and Surgical Journal, 1910, clxiii, p. 561.

empyema, and that pleural infections are sometimes seen after scarlet fever, measles, whooping cough, etc. The history and the physical examination are of the greatest importance. X-ray examinations are sometimes of help. But in cases of doubt the use of the exploring needle should always be resorted to, and I think it worth while to reproduce the description of the technique advocated by Robinson in the paper referred to. After freezing the skin with ethyl chloride, a  $\frac{1}{2}$  per cent. solution of cocaine is injected in the skin covering an area of  $\frac{1}{2}$  cm. Through this the hypodermic needle is inserted perpendicularly, the solution being forced gradually ahead of the needle as it passes through the layers of the chest wall. In the resulting absence of sensitiveness, the upper border of the rib below can be carefully made out, and more of the solution forced through the intercostal muscles against the sensitive pleura, which absorbs the cocaine slowly from the adjacent tissues. Puncture of the pleura then causes no pain. If the hypodermic needle is not used for aspiration, an aspirating needle can be inserted through the same channel with no discomfort. If aspiration is negative, by this anesthetic method of thoracentesis, the usual fear of the patient of another stab is avoided, and the persistence of the operator to search further is not discouraged. If abscess of the lung has been excluded by the absence of sputum, as is invariably justifiable, and the presence of pus is still suspected, it is fair to presume, after a series of negative punctures in the suspected areas, that the pus is encapsulated in a fissure, or on the diaphragmatic surface.

In children, the disease is usually more acute and usually recognized at an earlier period. Dunlop's description of the clinical aspects is excellent and worth abstracting. In the pneumonic cases the effusion occurred within a few days of the crisis, and the onset of the empyema was then either acute and violent, or insidious and indefinite. In 6 cases of young children an attack of convulsions was the earliest indication of the onset of empyema, while the other symptoms, in the order of frequency, were fever, cough, vomiting, rapid breathing, sweats, restlessness and delirium. In older children these symptoms were less pronounced but the child gradually assumed a languid appearance, became peevish, and had an anxious, careworn look, suffered from a short, paroxysmal cough, and emaciated rapidly. He warns against the failure to make the diagnosis, stating that he has frequently had infants sent to him with the diagnosis of tuberculosis following empyema when they were only suffering from empyema. The amounts of fluid varied from  $\frac{3}{4}$  oz. to 40 oz. In almost every case the child looked seriously ill, anxious, pinched, and profoundly anemic. The exudation of pus into the pleura is almost invariably accompanied by very rapid, and sometimes extreme, emaciation. This symptom is seldom wanting, and he regards empyema as one of the most characteristic of the wasting diseases of children. When a child is sent to him as suffering from

marasmus, he always excluded three diseases, viz., tuberculosis, congenital syphilis, and, lastly, empyema, before coming to the conclusion that the diagnosis is correct. The muscles become flabby and wasted, and the child appears prostrated, exhausted, and suffering from extreme cachexia. There is usually some cough, either suppressed or paroxysmal in character, and the breathing is accelerated, but never to the same extent as we find in pneumonia. Indeed, it is surprising, even when the pleura is full of pus, how little real dyspnea we find. There is generally a rise of temperature of from  $3^{\circ}$  to  $4^{\circ}$ , and it may be very high, but, on the other hand, especially in cases where the emaciation is marked and in young infants, there may be no rise in temperature at all, and it may even be subnormal, which is a very misleading sign. In 10 of his cases there was either a normal or subnormal temperature during the whole period the child was under observation. When an empyema has lasted a long time without being operated on, there is often clubbing of the fingers, and he has on one or two occasions witnessed these symptoms after a few weeks. A leukocytosis of from 20,000 to 30,000 is generally present when the fluid is purulent. Occasionally, we find the cheeks flushed and the child perspiring, but more often the skin is pale, dry and harsh. It is often mentioned as helpful in the diagnosis that we find diarrhea, but his experience does not bear out this statement, and few of his cases suffered from this symptom. Such then are the symptoms characteristic of empyema, and they form a very striking clinical picture.

As to *physical signs*, he emphasizes the importance of the finding of absolute boardy dulness at the base accompanied by a boxy percussion note at the apex, especially if there is loud, harsh, exaggerated breathing about the area of dulness and on the opposite side. Vocal fremitus is of little help in children, and loud, tubular breathing is often heard over the pleural effusion. There is, of course, definite expansion on the affected side and in some cases flattening. Displacements of the apex of the heart are more marked in left-sided effusions and in any case are a valuable aid in the diagnosis.

**PROGNOSIS.** The mortality in empyema is exceedingly large, and a glance at the statistics of the present day shows but little change from those of a decade ago. The following were published during the last two years and represent the experience of those who have reported a large number of cases. There are many other reports of small groups of cases in the literature.

	Cases. Deaths.		Mortality.	
Dunlop . . . .	98	20	20.4 per cent.	All children
Dowd . . . .	285	76	26.6	" 238 children
Werner . . . .	178	39	21.9	" All children
Hirano . . . .	118	26	22.0	" 93 children

Hirano separates his cases and showed a mortality of 50 per cent. in adults, and 15 per cent. in children. This showing is at variance with other statistics. Werner had a mortality of 41.5 per cent. in 41 children under two years, and Dunlop a mortality of 36 per cent. in 30 cases.

Mention has been made of the relation between the infecting organism and the prognosis, and, despite occasional contradictions, it is true that the metapneumococcic empyema give the best prognosis. Dunlop states that in pneumococcal cases where the patient was over two years of age recovery almost invariably occurred, and Pribram,<sup>1</sup> in reporting 100 cases of empyema and lung abscess, had a mortality of only 13 per cent. in 23 pneumococcal cases. Gerhardt<sup>2</sup> reports 4 cases of pneumococcic empyema treated by tapping, with recovery in all. On the other hand, Zybelle<sup>3</sup> reports 22 cases occurring in infants under one year, with 15 deaths; 14 of these cases showed pneumococci in the exudate and 8 of them died, 7 of which were treated by puncture.

The usual causes of death are bronchitis, pneumonia, pericarditis, peritonitis, and sepsis. Dunlop noted purulent pericarditis in 40 per cent. of the fatal cases; it was most frequently associated with left-sided empyema in growing infants and was often undiagnosed during life. He states that it should always be suspected after operation when the pleura is draining freely if the child continues to look ill, with an anxious appearance, dyspnea, and a rapid pulse. Dowd<sup>4</sup> obtained 24 autopsies in the 76 deaths of his series, and found pneumonia, 16 times; pneumococcic peritonitis, 5 times; pneumococcic meningitis, once; pericarditis, 4 times; compressed lung, 7 times; tuberculosis, twice; edema of the lungs, once; etc. Werner reports that 14 of his 39 deaths were due to sepsis; 3 from pneumonia; 3 from nephritis; brain and lung abscess, endocarditis, etc. were also lethal causes. In the septic cases, operation brought no amelioration of symptoms, fever continuing and in about two weeks death occurred; a bacteremia was almost invariably found.

There are statistics existing showing that a large proportion of the adult cases exist for months and of the children for weeks before a diagnosis is made. This appears to be the crux of the situation and it seems to me that early diagnosis and early operation should be reiterated by surgeons again and again, just as we do in cancer or in acute appendicitis. Our medical colleagues should "wake up" to the importance of this fact and realize the enormous mortality now attending the occurrence of empyema of the chest.

**TREATMENT.** The methods in vogue in the treatment of empyema of the thorax are exceedingly old and were it not for the complicating bony wall and the shrinkage of the lung, but little would be written

<sup>1</sup> *Archiv f. klin. Chir.*, 1914, ciii, 871.

<sup>2</sup> *Mitt. a. d. Grenzgeb. f. Med. u. Chir.*, 1913, xxvi, 695.

<sup>3</sup> *Monatsschr. f. Kinderheilk.*, 1912, xi, 93.

<sup>4</sup> *New York State Journal of Medicine*, 1914, xiv, 342.

on the subject. Just as in pus collections elsewhere, we have two indications to be met, the removal of the pus and the prevention of its regathering; this simply means incision (or puncture) and drainage. In addition, we must endeavor to restore the respiratory apparatus in its anatomic and physiologic relations as completely as possible.

1. *Aspiration or Thoracentesis.* This method of treatment finds but little favor with surgeons at the present time, except possibly in patients who are desperately ill, and where it is thought that the removal of the pus by aspiration will better enable the patient to gain increased resistance. Many years ago this subject was thoroughly thrashed out and the names of those who took part in the discussion at that time are almost completely forgotten; if frequent aspiration had merit, it would have survived the test of time.

In 1908, Murphy described his formalin-glycerine injection, whereby, after aspiration, the cavity is filled with a small quantity of a 2 per cent. solution of formalin in glycerine, prepared twenty-four hours previously. There has been but little written on this subject, however, although a number of writers allude to it with more or less approval. McPhedran<sup>1</sup> reports 6 cases, 4 of which were cured and the result in the others not definitely stated. Nyström<sup>2</sup> reports 10 cases, in 5 of which the method proved useless.

2. *Thoracotomy With, or Without, Rib Resection.* The three points about which controversy has arisen in the treatment of acute empyema are: (1) Whether to remove a portion of the rib or ribs; (2) whether to use suction drainage, and (3) whether we should always seek the most dependent part of the cavity. In 1909, Friedrich,<sup>3</sup> before the American Medical Association, advocated, in every recent empyema, puncture with a thick trocar and the introduction through it of a fenestrated Nelaton catheter. Over this is slipped a piece of rubber dam which is fastened to the skin by adhesive plaster. If the catheter is continued into a soft-walled drainage tube, a valvular mechanism is produced which permits the drainage of the exudate and prevents the occurrence of pneumothorax. Friedrich also states that after the pus focus in the pleura has become encapsulated, the resection of one or two ribs may be done at any time if the Thiersch method proved insufficient. This technique has been referred to a number of times in the literature of the past five years, but there seems to be no unanimity of opinion, some believing that puncture drainage will cure many of the cases operated early while others point out that the secondary operation is so often required for insufficient drainage that it should be done primarily to save valuable time. My own experience corresponds with that of Lund<sup>4</sup> who states "that unless the suction apparatus is extraordinarily

<sup>1</sup> Canadian Medical Association Journal, 1914, iv, 766.    <sup>2</sup> Hygeia, 1913, lxxv, 849.

<sup>3</sup> Journal of American Medical Association, 1909, liii, 1970.

<sup>4</sup> Boston Medical and Surgical Journal, 1911, clxv, 394.

efficient, and unless the after-care be carried out with greater efficiency than is generally possible, little is gained. Again, after the removal of a small tube, the drainage opening, being small, is likely to contract, shut up a small quantity of pus which gradually increases until it becomes of formidable size and draws the lung upward and backward." I have had a few successes and many failures from both the Thiersch and the Robinson methods. The Ingals trocar is the most efficient instrument for puncture that I have seen, and allows a 1 cm. tube to be easily introduced. At the present time I am confining the Thiersch method to those cases seen in young children when the pus is thin (often pneumococcic) and the child seems too ill to stand any but the simplest procedure; a little novocaine and a steady thrust provide ample drainage for a few days at the least, without any disturbance of the child's state. When the child's condition is good, when the pus is thick, and in adults, I perform rib resection. Dunlop prefers incision in young infants, made in the sixth interspace in the mid-axillary line. He operated on 29 cases, with 5 deaths (17.2 per cent.); whereas 61 cases had a rib resected with 14 deaths (23 per cent.).

Robinson's<sup>1</sup> method is most ingenious and might be mentioned, as it was omitted for some reason from previous numbers of this journal. He published his paper in 1910 and advocated trephining the rib and the screwing of a metal tube into the opening; the wound was then closed, an air-tight dressing applied and the disk of pleura beneath the tube excised. A suction apparatus was then applied. Later, Robinson<sup>2</sup> explained that he did not recommend suction drainage in all cases, but that in the acute type with a movable lung, a certain indication exists. We tried the method in a few cases in Dr. Frazier's service in the hospital of the University of Pennsylvania but I fear they were not properly selected, for, with one exception, they came to a rib resection later. Von Eberts<sup>3 4 5</sup> has written papers in 1910, 1911, and 1912 upon tension drainage in empyema. He resects 2 or 3 cm. of a rib with a Gigli saw, plugs the explored stumps with Horsley's wax, incises the pleura and allows the pus to escape. As soon as there is a tendency for air to enter the thorax, the wound is plugged with the finger during inspiration and the tube inserted. The felt pad (a), rubber dam (b), and rubber flange (c), as shown in the illustration, press together and are held against the chest by means of adhesive plaster, completely covering the rubber. A gauze pad and bandage complete the dressing. If the discharge is profuse, capillary leakage may occur for the first two or three days, but pneumothorax is absolutely prevented. The upward turn of the inner extremity of the tube is designed to prevent painful

<sup>1</sup> Boston Medical and Surgical Journal, 1910, clxiii, p. 561.

<sup>2</sup> Journal of American Medical Association, 1912, lix, 272.

<sup>3</sup> Annals of Surgery, 1910, lii, 502.

<sup>4</sup> Ibid., 1911, liv, 58.

<sup>5</sup> Journal of American Medical Association, 1912, lix, 264.

pressure upon the diaphragm or lung. As the inner wall of the cavity approaches the chest wall, a tube with a shorter projection beyond the cone is employed. If there is no danger of pocketing, the tube may be cut off at the apex of the cone. He cuts the skin with a circular knife like a punch and hence does not use sutures. The air in the bulb is exhausted by means of a Politzer bag. In redressing, the sinus is plugged with gauze or covered with a small Bier's cup as the tube is being removed. The skin is then cleansed with ether and smeared with the following ointment: Phenol (carbolic acid), 1 per cent.; zinc oxide, 15 per cent., yellow petrolatum, 100 per cent., the petrolatum to have a melting point of 104° F. The use of this ointment prevents excoriation, and also increases the adhesive properties of the zinc oxid plaster. The inner side of the felt pad is smeared with the same ointment. As the patient holds the breath on expiration, the tube is inserted and fastened in as before. It is well to have two tubes, to be used at alternate dressings in order to avoid delay. In his third paper, Von Eberts advocates the use of this method in "chronic unopened empyema," where the cavities have not been exposed to post-operative pneumothorax and unchecked secondary infection. He reports two cases cured. The method may be used whenever "tidal air" is demonstrated, and, furthermore, the continuance of tidal air is an indication for the continuance of negative tension.

Tennant's<sup>1 2</sup> paper, published in 1910, has been previously mentioned, and he reiterates his views this year. He resects about two inches of the rib, introduces several large drainage tubes and simply keeps them free from fibrin by means of a syringe. About the fourth or fifth day after operation, a large suction cup is used two or three times daily for twenty minutes at each sitting, the patient being instructed to take deep inspirations and to cough. He believes that this helps to obliterate the pleural space, empties undrained pus, and breaks up fresh adhesion bands. Not later than the eighth day all drainage tubes should be removed, the suction cup being continued thereafter and in certain cases it may be strapped in position.

Tennant suggests the use of the cystoscope to illuminate the cavity in the search for adhesions and pus pockets. Personally, I have been using the method described by Brewer,<sup>3</sup> continuing the suction for five or six days and then having the patient use the familiar "blow bottles," twice daily until the sinus heals. The method has given perfect satisfaction. Finally, Lawrow<sup>4</sup> has published the best study of aspiration after thoracotomy that I have seen. Unfortunately, he uses the clumsy Nordmann apparatus, first described in 1907. He shows

<sup>1</sup> PROGRESSIVE MEDICINE, March, 1910, p. 96.

<sup>2</sup> Colorado Medicine, 1914, xi, 215.

<sup>3</sup> Keen's Surgery, vol. vi, p. 381.

<sup>4</sup> Beit. z. klin. Chir., 1913, xxxiii, 67.

that moderate negative pressure has apparently no influence on the heart rate or upon blood pressure; the inspiratory rate usually became deeper and the lung capacity increased several hundred cubic centimeters. A number of other interesting experiments and observations are described in his paper.

Hahn<sup>1</sup> discusses the treatment of acute empyema, and favors puncture and drainage with aspiration. He states that in 25 cases, recovery was complete in 80 per cent.; 3 patients were not cured, and 2 patients (8 per cent.) died. Among the 25 cases there were 9 children between two and seven years, and the empyema, in the majority of cases, followed pneumonia. He states that rib resection has several disadvantages, among which are greater operative danger, especially from the quick decrease in pressure, and post-operative pneumothorax, to avoid which a complicated apparatus is necessary. Most writers who mention these facts, however, forget that there is but little essential difference between the effect of pus or air in the pleural cavity in so far as pressure is concerned; as the pus escapes, air takes its place, and in this way sudden decrease in pressure does *not* occur and post-operative pneumothorax makes no difference.

In the matter of anesthesia, every writer is in agreement that local anesthesia is to be preferred to general anesthesia. Ether inhalation is not good treatment for pneumonia, and a practically painless operation can be done with care in the injection of the anesthesia. In spite of the good reports of a few writers, the majority favor the removal of a portion of rib at the primary operation. The opening thus obtained permits the exploration of the cavity with the finger and enables one to sweep out the coagula if such are present.

Pribram<sup>2</sup> writes from v. Eiselsberg's clinic recommending resection of the sixth, seventh, and eighth or more ribs. After the pus has been slowly evacuated, he drains with several tubes and sometimes uses packing. Aspiration drainage is recommended only in mild metapneumonic empyemas. Such extensive opening at the primary operation seems unnecessary, and the mortality of this clinic (27.5 per cent.) hardly justifies the method.

Thomas<sup>3</sup> has published two papers dealing with the subject of dependent drainage. He observed, in the post-mortem room, a body containing an empyema in the right chest, the cavity of which, although a large one, was distinctly and firmly circumscribed below by the junction of the diaphragm and chest wall and above by adhesions between the lung and the chest wall. Upon this one observation he bases a study of empyema, and believes that practically all acute empyemas are

<sup>1</sup> Deutsche med. Wochenschr., 1913, xxxix, 1830.

<sup>2</sup> Archiv f. klin. Chir., 1914, ciii, 871.

<sup>3</sup> American Journal of the Medical Sciences, 1913, cxlv, 405 and 555; Pennsylvania Medical Journal, 1914, vol. xviii, p. 111.

encysted and localized by surrounding more or less firm adhesions as in appendicular or other abdominal abscess, or the small so-called local empyema. He believes that most empyemas extend from the bottom of the pleural cavity a variable distance upward. He believes that the adhesions will not seriously hinder the re-expansion of the lung after the pus has been evacuated, and that the cavity will be filled by re-expansion of that portion of the lung which presents upon, or projects into, the cavity. Thomas proposes the following method of treatment: A puncture wound is made in the seventh interspace, and a somewhat rigid probe or long grooved director, curved at the end, is introduced through this opening and the end made to seek the lowest limit of the empyemic cavity, which usually corresponds to the bottom of the normal pleural cavity near the spine. The end of the probe will usually be felt in the eleventh interspace and over this place a vertical incision is made, the rib, usually the eleventh, exposed and a small portion excised in the usual way. A drainage tube is then introduced and a suture or two may be necessary. He believes that with such an opening the empyema will be perfectly drained in almost any position the patient is likely to occupy. In his second paper, he reports 10 cases operated on in this way, and states that he has operated by excision of a rib at the bottom of the cavity in 9 cases and by an intercostal opening in the same position in 10 cases. As a result of this experience, he states in his second paper that he prefers the intercostal opening because it is smaller. In only one of the 19 cases did the general condition of the patient fail to improve remarkably in the first week and that one ultimately got well. One case died, a child who also had whooping cough. The average duration of his cases was six or seven weeks.

In the discussion of this paper before the College of Physicians, Jopson<sup>1</sup> objected to the low posterior incision owing to the risk of injuring the diaphragm and the presence of adhesions obliterating the costophrenic sinus. Dowd also warns against resecting below the eighth rib in the posterior axillary line owing to the danger of injuring the diaphragm and states that he has seen this done by three different surgeons, one of them the acknowledged leader of his time. He prefers removal of a portion of the rib owing to the better drainage obtained. De Bovis<sup>2</sup> also believes in a low opening, and states that if the first opening does not answer the purpose, he closes the incision and makes a second one. He also objects to the use of the tube or tampons, believing that better drainage is obtained without them. He has applied his technique in only 3 cases and while he obtained recovery in from three to five weeks, it does not seem to me that he has had enough experience to prove his contentions.

<sup>1</sup> Transactions of the College of Physicians of Philadelphia, 1912, xxxiv, 366.

<sup>2</sup> Sem. Méd., 1914, xxxiv, 349.

**Visceral Pleurectomy (Decortication).** In 1893, George Fowler,<sup>1</sup> in operating on a woman with chronic fistula following empyema, dissected out the entire mass of fibrous tissue from the sinus, the diaphragm and from over the lung; the lung began to re-expand immediately and the patient recovered. In 1894, DeLorme<sup>2</sup> devised the same operation independently, and, abroad, the operation is generally known by his name. There are not many cases of decortication on record. Mayo and Beckman<sup>3</sup> state that they have been able to find but 24 cases reported in the literature by three operators in the twenty years that have elapsed since the reports of George Fowler and DeLorme. In 1908, Bergeat<sup>4</sup> wrote a complete report of the subject and reported 7 cases. There are a number of other reports in the German<sup>5</sup> and French literature. In 1909, Ferguson<sup>6</sup> states that he had performed six operations, but does not give the details of the cases. Dowd<sup>7</sup> reported his results in 15 cases, 12 of the patients being in excellent health at a period varying from a few months to nine years after operation with varying degrees of chest expansion and chest capacity, and without lateral curvature of the spine. There was one death from the operation; 14 of the patients were children. In a later report by Dowd,<sup>8</sup> he states that he has operated upon 4 additional cases; one, an adult, failed to secure healing and died from exhaustion; the other 3 are still under treatment, one having a bronchial fistula. He makes a further report of his 19 cases and states that 11 of them have secured good healing and are enjoying good health. In 1911, Lund<sup>9</sup> reported 7 cases, of which 4 had decortication as a primary operation. Two of the 7 patients died, one of septicemia and the other of pneumonia.

The report of Mayo and Beckman has been referred to, and Beckman,<sup>10</sup> in a separate paper, reports 5 cases illustrating the possibility of decortication and infers that 11 operations have been performed in the Mayo clinic with one death.

**TECHNIQUE.** Lund resects one and a half inches of five or six ribs through an incision running upward and forward from the anterior end of the old drainage incision. Dowd incises around the sinus opening and resects 3 or 4 inches of the two adjacent ribs and carries the incision upward, if necessary, in the anterior axillary line as far as the third rib. He removes graduated portions of the ribs so that from 4 to 6

<sup>1</sup> Medical Record, 1893, vol. xlv, p. 838.

<sup>2</sup> Gaz. d. Hôpitaux, 1894, vol. lxvii, p. 94.

<sup>3</sup> Annals of Surgery, 1914, lix, 884.

<sup>4</sup> Beit. z. klin. Chir., 1908, lvii, 373.

<sup>5</sup> See also Kurpguweit, Beit. z. klin. Chir., 1902, xxxiii, 627.

<sup>6</sup> Transactions of the American Surgical Association, 1909, vol. xxvii, p. 156.

<sup>7</sup> Journal of American Medical Association, 1909, liii, 1281.

<sup>8</sup> New York State Journal of Medicine, 1914, xiv, 344.

<sup>9</sup> Journal of American Medical Association, 1911, lvii, 693.

<sup>10</sup> Northwest Medicine, 1914, vi, 68.

inches are removed from the tenth rib and  $\frac{1}{2}$  inch from the second or third rib. Russell Fowler<sup>1</sup> incises parallel with the ribs, the centre of the incision being at the old drainage opening. The rib is removed subperiosteally and the cavity explored. He enlarges upward from the posterior extremity and resects as in the manner described by Dowd. All of the writers minimize the danger of bleeding from the intercostal vessels and state that they can be grasped as the parietal pleura is cut. Mayo and Beckman incised the visceral pleura posteriorly; Lund incised it over the lower part of the lung; and Fowler tries to find a line of cleavage with the parietal pleura in order to avoid injury to the lung itself.

As soon as the peeling is begun, the finger may be inserted, and, as Lund describes it, swept to and fro over the soft surface of the lung with the pulp of the finger toward the pleura and pressing outward so as to cause the least possible damage to the lung. At this stage of the procedure, Dowd allows the patient to nearly emerge from the anesthetic to promote expansion of the lung, and also states that, in most of his cases, a strip was removed representing somewhat more than the pulmonary portion of the sinus lining. Lund emphasizes the necessity of separating the basal adhesion to the diaphragm. The danger to the lung is inconsiderable, and, if lacerated, warm saline pads will control the oozing. The most disturbing complication is a fistula opening between the bronchus and the pleural sinus. If, after removal of the thickened sinus wall, the lung does not come up to the incision, Dowd calls attention to Lloyd's<sup>2</sup> suggestion to make an extensive separation of the adhesions which bind the lung to the chest wall; or to follow Gerster<sup>3</sup> and resect the ribs beneath the scapula, thus permitting the subscapularis muscle supported by the scapula to lie against the compressed lung. DeLorme, and most of the French authors, employ a large thoracoplastic flap through which they decorticate, but this is objectionable because of the almost impossible task of preventing pneumothorax from leakage of air and the re-establishment of the lung collapse.

DISCUSSION. Ramsdoff,<sup>4</sup> in 1906, proposed a modification of the decortication operation, gridironing the pulmonary pleura with many parallel incisions removed from each other about a quarter of an inch, and crossing these obliquely or at right angles with other cuts. Recently, Lund<sup>5</sup> stated that in performing decortication he had been leaving little patches of pleura which were useful in favorable cases in suturing part of the lung to the chest wall. Lepente<sup>6</sup> makes a thoracoplastic window of moderate size, separates the adhesions between the visceral

<sup>1</sup> *Surgery, Gynecology, and Obstetrics*, 1914, xix, 667.

<sup>2</sup> *Annals of Surgery*, 1907, vol. xlv, p. 373.

<sup>4</sup> *Ibid.*, 1906, xliii, 501.

<sup>6</sup> *American Journal of Surgery*, 1914, xxviii, 397.

<sup>3</sup> *Ibid.*, 1913, lviii, 568.

<sup>5</sup> *Ibid.*, 1914, lx, 126.

and parietal pleura, and then makes numerous cuts through the visceral pleura. By means of a special spatula, he detaches the pleura from the lung, but does not remove it.

**Bismuth Paste Injections.** Some years ago Ochsner gave prominence to this method, originated by Beck, and reported 14 patients with persistent sinus after thoracotomy, with 85 per cent. cures. A number of recent writers refer to the subject, but do not give details. Beck<sup>1</sup> tabulates a few other reports, with success varying from 82 to 100 per cent.

**Pleural Vomicæ.** A purulent collection in the lung, pleura or liver which has burst into the bronchi and has been coughed up. Smith<sup>2</sup> has written an interesting paper on this rather unusual condition. He has found it to occur in 3.4 per cent. of his empyema cases, and he analyzes the clinical aspects and symptomatology of 16 cases. Four of these developed during the course of pneumonia; one in appendicitis; one in an infection of the mouth; two in chronic bronchitis with bronchiectasis; three in empyema; three in abscess of the liver. He states that four of the cases were considered as delayed pneumonic resolution; two as typhoid fever; two as bronchiectasis; and four others as various diseases of the lung. Naturally, bronchiectasis and abscess of the lung would give the greatest difficulties in diagnosis, and Smith believes that in bronchiectasis there is generally a history of long continued chronic bronchitis, a gradual onset of characteristic sputum, and the signs of cavity, whereas in pleural vomicæ the signs of fluid remain constant. Moreover, the röntgenogram gives a definite shadow over the site of the pleural vomicæ, while over the lung there is a circular shadow of the cavity wall with the clear area in the centre. Three of the 16 cases died from pulmonary abscess and gangrene, from myocarditis, and from shock following an extensive thoracic resection. The remaining cases were complete recoveries.

In the discussion of this paper, Robinson stated that he believed that the first infection of these cases is a pulmonary one, and, if an empyema exists, it is the result of the abscess bursting from the periphery of the lung into the pleural space. But Smith did not agree with this view, and believed that, in a large proportion of the cases, the pus does actually perforate from the pleural cavity into the lung just as in empyema necessitatis it perforates the parietal layer of the pleura into the chest wall.

**Post-operative Empyema.** An instructive article on post-operative pleurisy with effusion and empyema has been written by Burnham,<sup>3</sup> who studied the records of the Presbyterian Hospital in New York in order to determine the incidence and comparative severity of these

<sup>1</sup> *Annals of Surgery*, 1914, lix, 145.

<sup>2</sup> *Journal of American Medical Association*, 1912, lix, 2031.

<sup>3</sup> *Surgery, Gynecology, and Obstetrics*, 1914, xix, 468.

complications. In 13,013 operations, dry pleurisy occurred 45 times; pleurisy with serous effusion, 14 times; and empyema, 6 times. The 20 cases of effusion are then considered, and it was found that 18 followed acute abdominal infections and 2 followed operations upon other parts of the body. Of the 14 cases of serous effusion, 12 were in the right side and 2 in the left, and, of the latter, one followed operation for a pancreatic abscess and the other a nephrolithotomy on the left side. Two of the cases were presumably clean, and in 3 others there was apparently little or no infection and no abdominal symptoms. As evidence that pleurisy was due to some infective agent as the original disease, it was shown that in 9 the temperature due to the pleurisy was either continuous with post-operative temperature, or rapid after a lapse of less than forty-eight hours. The symptoms were those of pleurisy with effusion from whatever cause, and the treatment was mostly expectant. Of the 14 cases, one died, one was lost sight of, and the remainder recovered; 6 were aspirated from one to three times, and Burnham suggested aspiration when necessary, the use of hexamethylenamin, and, if culture of the fluid shows bacteria to be present, the injection of formalin and of glycerin. The 6 cases of post-operative empyema, all followed severe suppurative conditions and all died. Two of the cases originated from a perforated ulcer, and Burnham states that signs in the right chest following the repair of a perforated ulcer should always lead to the immediate exploration of the pleural cavity, and, in addition, a most careful examination should be made to exclude the possibility of subphrenic abscess. In 4 of these 6 cases, subphrenic abscess was present, and in another case its presence was doubtful. Burnham concludes that a turbid or purulent effusion occurring in the right chest following laparotomy requires immediate drainage, and should lead at once to the exploration of the subphrenic space.

Pribram<sup>1</sup> reports 4 cases of post-operative empyema, 3 of which succumbed. The empyema followed a liver abscess, a perforated carcinoma of the stomach, a perinephritic abscess, and a case of appendicitis with subphrenic abscess.

<sup>1</sup> *Archiv f. klin. Chir.*, 1914, ciii, 871.



# INFECTIOUS DISEASES, INCLUDING ACUTE RHEUMATISM, CROUPOUS PNEUMONIA, AND INFLUENZA.

BY JOHN RUHRÄH, M.D.

THE number of articles written on the subject of infectious diseases during the past year was normal up until the outbreak of the European War. About August 1, following the beginning of the war, there was a great diminution in the number of medical journals published. The French journals, for the most part, stopped publication entirely, or continued as small sheets devoted largely to things of military interest. For some reason the Italian journals, for the most part, suspended publication, or, at any rate, the journals did not reach this country promptly, and at the time that this manuscript was finished very few of the German journals had reached this country. The various *Zentralblätter* have not been issued, and the same is true of some other reviews. Some of the larger German journals have continued with very little change, but their arrival in this country, owing to transportation difficulties, has been more or less spasmodic. The English journals have decreased in size and interest, so that the reader must appreciate that this year's review was made from very much less material than heretofore.

Last year, the chief interest centred around the growing of the organisms of poliomyelitis and rabies, and certain studies made upon cerebro-spinal fever; this year the interest, as usual, has shifted, and it is difficult to say what the most striking contribution has been.

One of the most important things, from a practical standpoint, has been the consideration of the aerial transmission of infectious diseases. This whole subject is being restudied, and much has been taught us; chiefly, that the air does not play a very important part in the transmission of most infections. In former days, yellow fever and malaria were regarded as types of disease transmitted through the air. We now know that this is impossible in either of these diseases, and the result has been a saving of millions of dollars worth of property, and much valuable time in the question of quarantine, and it has been possible through an understanding of these diseases to effectively prevent epidemics. The work with ordinary infectious diseases has not been so striking, and yet the present day practice of housing infectious diseases in isolation hospitals is very remarkable when contrasted

with the attitude of the public and of the medical profession a few years ago.

Among the lines of therapeutics, the sensitized vaccines are coming into their own, or, at least, attention has been drawn to them that ought to result in remarkable advances. The sensitized vaccines suggested by Metchnikoff and Besredka have not received the amount of attention that they would seem to warrant. There is little doubt that, with a more thorough study, and a better understanding of certain diseases in which vaccines have proved to be most satisfactory, a larger number of cases will be brought into the range of a very positive therapy by their use. The same is true, perhaps, even to a greater degree, of the production of immunity for the purpose of the prevention of disease.

Just when it seemed that bacteriology was at a standstill, Rosenow and others have come forward with reports of their studies in various infections by means of a special method of cultures, and they have shown that it is possible to detect bacterial infections in the blood and in the tissues by their method where heretofore no organisms could be obtained. Their work, particularly on the subject of the streptococcus infections, is of the greatest possible value, and no one interested in infectious diseases can fail to be struck by the possibilities of further study along this line.

There have been important articles contributed on the subject of blastomycosis and sporotrichosis, conditions certainly much more common than is ordinarily supposed, and worthy of very careful attention, particularly by clinicians, a large number of cases of both infections being mistaken for other diseased conditions.

We have also, through numerous publications of various authors, obtained a better idea of the possibilities of the use of emetine in amebic dysentery. This method is very much superior to any that has been used heretofore, and, while it has some drawbacks, can be highly recommended. Following quickly upon the reports of the use of emetine in amebic dysentery, comes the announcement of its efficiency in another disease, which is apparently due to amebæ. For many years pyorrhea alveolaris, or Riggs' disease, has baffled the best efforts of dentists, and to a certain extent physicians, where they were consulted. It has been shown by Smith and Barrett that certain forms of entameba are always present in this disease, and that they can be killed by the use of emetine, either locally or hypodermatically, and a cure of the condition is brought about.

Diphtheria, in which interest had waned for a number of years, has been a subject of a large amount of research work, particularly in reference to the use of the Schick reaction and the protection of susceptible individuals, in the methods of administration of antitoxin and also in active immunization by means of mixtures of toxin and antitoxin.

While much has been done along these lines, the subject still seems to be one that will reward further study. The Schick reaction particularly ought to come into use in schools and colleges, hospitals, and asylums. Its practical application ought to do a great deal to lessen the incidence of diphtheria in institutions.

The treatment of leprosy has also attracted some attention, and the method of using chaulmoogra oil, hypodermatically, has resulted in the cure of a few cases.

There have been a large number of studies upon the subject of pellagra, all of which are well worthy of attention, and all of these seem to point to the disease as something in connection with nutrition rather than as an infection, although the question can not be regarded as settled by any means. The theory of Sambon, that the disease is transmitted by a species of simulum or gnat, has not been borne out by other observers.

There has been an increased interest in pneumonia, and the various methods of treatment and immunization, and while the results have not been very definite, possibly further studies along the same line will yield something that can be put into general use.

There are quite a number of contributions upon the subject of poliomyelitis, but no particular advances have been made over our knowledge of the previous year.

There have been some interesting studies made with regard to tetanus, particularly as to the methods of administering the antitoxin, and it has been found that giving the antitoxin intravenously in combination with a certain amount injected either into the muscles or subcutaneously has brought about far better results than have been obtained heretofore.

It is interesting to note, in passing, the complete collapse of the Friedmann treatment for tuberculosis; certainly a very striking lesson against the exploitation of untried cures through the press, but one which, unfortunately, will have no effect upon journalism in this country.

**The Air as a Vehicle of Infection.** In former days, in fact until very recently, the air has been considered the chief means of transmitting the various infectious diseases. One by one the infectious diseases have been studied, and many of the points of their transmission have been cleared up. At the present time, the air is supposed to play a very much less important part than ever before. The work of establishing these facts has been done by many observers. Chapin<sup>1</sup> has done much to put these newer ideas into practice, and also to popularize this knowledge. He calls attention to the fact that thirty years ago, yellow fever and malaria were considered typical air-borne diseases, and that sewer gas or air was supposed to be a very important factor in the production of typhoid fever, cholera, dysentery, and diarrheal diseases.

<sup>1</sup> Journal of the American Medical Association, February 17, 1914.

As early as the eighteenth century, some of the more careful observers doubted the importance of air in transmitting diseases, and among these may be mentioned Richard Mead in the eighteenth century, and William Budd in the nineteenth. Chapin considers the well-known facts concerning the factors of the various more prevalent diseases. The most important part of his article deals with scarlet fever, diphtheria, measles and whooping cough. Up to the present time, comparatively little has been furnished by the laboratory regarding the mode of infection of these diseases, but gradually a sufficient amount of clinical evidence has been brought together which tends to show that transmission by means of the air is of comparatively little moment, while contact infections from other cases or carriers is the essential thing to guard against. Fully fifteen years ago, Grancher became impressed with this idea, and started to treat cases of these diseases which developed in his wards without removing them into an isolation ward, but by using screens as barriers simply to indicate that the case was in isolation, and the cases were handled with an antiseptic technique similar to that used in the operating room.

As far as I know, this was the first attempt to disprove the older ideas, and the careful records of that experiment I have referred to more than once in connection with this subject. Since that time the barrier method of the use of cubicles or boxes has come into more general use.

Scarlet fever has always been regarded with particular suspicion as regards aërial transmission, but in the Hospital for Infectious Diseases in Providence, no especial incidence was noted in the crowded tenements only 150 feet away. Similar observations have been made in many other cities, all tending to show the same thing.

Diphtheria is apparently not air-borne, even indoors. Chapin states in the scarlet fever building in the hospital in Providence diphtheria carriers are almost constantly present, and the only isolation is by the barrier system, not only for carriers, but also for clinical diphtheria as well, and that only three cases of cross infection among 500 cases occurred. The same experience in infection pavilions and in general wards has been reported from practically all places where this method has been conscientiously tried. The infections which occurred are undoubtedly due to failure in the aseptic technique, and it is only remarkable that a greater number of infections do not occur from this cause.

In the case of whooping cough, there has been comparatively little hospital data at hand as this disease is rarely admitted to hospitals using the aseptic method. It is known, however, by those who have had a limited experience, that the disease is not carried through the air, and will not spread in a ward provided that the beds are sufficiently far apart. For this disease the air space must be comparatively great,

on account of the spraying of the germs of the disease in the small particles of mucus discharged forcibly during the cough. Biernacki found that the disease could be prevented from spreading if the beds are twelve feet apart, but he advises a canopy over the head of the bed to prevent the expulsion of visible droplets during the paroxysms.

Measles is still a problem, as a matter of fact, we know very little about the transmission of measles. There is considerable difference of opinion but the view that the disease is probably not spread through the air but through the failure in aseptic technique seems to be gaining ground. We all know that without taking any precautions in wards, measles is apt to cause other cases, if susceptible children are present. Grancher, with his technique, was able to reduce cross-infection in measles fully two thirds. At the Providence hospital, measles cases are cared for together with other diseases, in rooms opening into a common corridor. There is no attempt at air separation and different diseases are attended by the same nurses and physicians. Up to October 1, 1913, there had been 320 cases of measles in 669 persons suffering from other diseases. During most of the time measles was present. During the first nineteen months, 38 cases were admitted with only one cross-infection. After that, there were three outbreaks causing in all 23 cases and since May, 1912, there have been but two cross-infections derived from 139 cases of measles.

The explanation of this may lie in some unknown factor in the spreading of the disease or in the susceptibility to it, but what is more probable is that the measles virus, whatever it may be, is less easily washed from the hands of the nurses and physicians than is the virus of diphtheria and scarlet fever. Chapin is inclined to regard the cases as a failure of the aseptic method practices rather than aerial transmission.

THE EXPERIMENTS OF THOMPSON AND PRICE<sup>1</sup> are of considerable interest in this connection. In 1912, they decided to determine what they could do concerning this subject, and their experiments were conducted at the Fazakerley Hospital. The experiments were made in one ward of twelve beds, six on each side but with a single entrance. Their work had nothing whatever to do with either box wards or cubicles. At the beginning, measles was excluded, and certain precautions taken with chickenpox. The ward was well lighted and ventilated, and had 15 feet of wall space and 195 feet of floor space for each patient. Everything possible was done to prevent carrying the infections from one individual to another. Separate utensils were used for feeding, and clothing was either reserved for the individual or sterilized before using. The only extraordinary precaution taken in regard to infection was in the case of chickenpox. When it was possible the child in the next bed was selected from those having old scars of that disease. As a result

<sup>1</sup> *Lancet*, June 13, 1914, p. 1669.

of their experiences, they feel that no deductions should be made from hospital statistics when the list of the different infectious diseases does not show the day of disease on admission to the ward, the ages of the patients, and the number of protected and unprotected individuals. They believe that if they could select the day of the disease on which the patient was admitted, the infectious disease could be treated in the open ward more satisfactorily than in the cubicle ward, as the ventilation is better in the open system. They call particular attention to the fact that their experiments were carried out in a well ventilated room, and with ample space for each patient. They believe that scarlet fever is not carried through the air. Their evidence as to whooping cough is less definite, and they are not sure whether it may be transmitted through the air or not. With measles they believe that the infection is probably transmitted through the air early in the disease, but the power of infection soon passes. Perhaps the most interesting of their results is the view that chickenpox is transmitted through the air early in the disease, but probably after the third day it is not carried in this manner. There were no cross infections from diphtheria, German measles, or mumps, but the number of these cases was too small to draw any definite conclusion.

**Sensitized Bacterial Vaccines.** The subject of bacterial vaccines made of killed bacteria treated with specific immune serum has recently been attracting much attention, although the subject is by no means new. In earlier studies in immunity, attempts were made to combine the immunizing effects of serum with the more lasting immunity produced by vaccines. These earlier experiments produced only a passive immunity of short duration.

In 1912, Besredka described what he called *virus vaccine sensibilisés* or sensitized vaccines. These were prepared by mixing the bacteria and the serum, and, after allowing this mixture to stand for some time, separating the bacteria from the serum, by means of a centrifuge, and washing them free from the serum by the use of salt solution, and repeated centrifugalization. The bacteria attracts the antibodies in the serum, and this renders them ready for phagocytosis, and also to be acted upon immediately by the complement.

For those not familiar with the subject of immunity, a very simple, if perhaps not quite accurate explanation may be made of this subject, by assuming that in immunity we have to deal with three things; the antigen, or bacterial poison, either dead or alive, a complement in the body, which, when joined to the antigen by means of an antibody (amboceptor or sensitizer), renders the antigen or toxin harmless. This is like coupling two cars with a link, the antibodies being the link.

With the ordinary vaccines made of killed bacteria, we have only the antigen, this injected into the body stimulates the formation of antibodies or connecting links, and from a week to ten days are necessary

before a sufficient number are produced. But when they are produced, we have an excess, so that, after several injections of vaccine, the body remains for a greater or less length of time in a condition of immunity, due to the presence of antibodies ready to join the complement to the antigen as soon as it does appear, and so preventing any disturbance of the body health.

With the sensitized vaccine the antigen with an antibody is supplied at once; this permits the complement in the body to be used immediately, so that with sensitized vaccines, the effect is produced quickly. Another important point is that it is not necessary to wait a week or ten days before repeating the injection.

Sensitized vaccine may be made by placing emulsions of bacteria in immune serum which has been heated to  $56^{\circ}$  C. to destroy the complement. The bacteria agglutinate and fall to the bottom and may be readily washed free of the serum by means of salt solution. Ordinarily the culture is grown in agar for twenty-four hours, the emulsion usually being made with normal salt solution. After filtering through fine silk, the immune serum corresponding to the bacteria used is added. This is left at an ordinary room temperature, with frequent shakings for twenty-four hours, when more salt solution is added, and the mixture centrifugalized. This is repeated several times, after which the bacteria are counted, and the emulsion is made for use in treating disease.

Besredka used the live sensitized bacteria, and if properly made, they are undoubtedly harmless, but in ordinary usage the bacteria are killed by the use of phenol or heat. It is claimed that by using sensitizing vaccine, the bacterial power of the blood serum is rapidly increased, and that there is a rapid appearance of antibodies and that they are found in very much larger quantities than after ordinary vaccine.

In addition to this, the rapidity of action is of great value, as twenty-four hours after the first injection the effects of the active immunity may be noted. This is valuable not only in the treatment of acute infectious diseases, but also for producing prophylactic immunity. Inasmuch as the vaccines are saturated with antibodies they do not unite with those in the body which may have been formed by the existing infection, and there is consequently no reaction or so-called negative phase. They also produce little, or no, local or general reaction, and, while it is not known what may be expected of them, there is no reason that extensive experimentation should not be carried out, and it is quite probable that eventually a certain number of highly important therapeutic discoveries may be made.

**The Isolation and Quarantine Periods in the More Common Infectious Diseases.** The regulations of health departments and of physicians on this subject are so much at variance that any authoritative statements are welcome. We undoubtedly will arrive at a period when our knowledge of the infections will be such that we can state, without fear

of contradiction, how long to isolate any particular disease, but we have not as yet reached that time. Ker<sup>1</sup> believes that the whole subject may be restudied to great advantage, and in this opinion I am sure most everyone will concur. His views on scarlet fever are noted under that disease.

**DIPHTHERIA.** In diphtheria he believes that the patient should be kept until the necessary negative cultures have been obtained. He believes that in many instances the effects of the disease last much longer than the infectivity and that, if one obtains two negative cultures even as early as three or four days, a strict quarantine need not be continued. He believes that persons coming in contact with diphtheria should be very carefully studied with cultures, and that the carriers should be isolated. He has found this procedure safe and efficient in hospital outbreaks and he sees little use in quarantining contacts for a fixed period unless cultures are taken. The length of time a carrier is a source of danger he does not touch upon, a point which is well worthy of consideration as undoubtedly much hardship may be worked by the isolation of individuals showing the presence of germs in their throats with the morphology of the diphtheria bacillus but which are not capable of transmitting the disease. I think that, as a general rule, it will be found that in such individuals, if they have not been in contact with actual cases of diphtheria the organisms will generally be found to be free from virulence and such carriers are not a source of danger. Those who have been in contact with actual cases of diphtheria are the ones that are a particular source of danger, and just how long the diphtheria bacillus may retain its virulence without causing any disease in the carrier is, as yet, unknown. Probably at this time the only way to determine this will be to test the virulence of the organisms found. This is an expensive and troublesome procedure and in most cases not practicable. There are others who believe that after two or three weeks elapse such carriers are not a source of danger, or only a very occasional source.

**MEASLES.** Ker believes that measles should be isolated for two weeks after the beginning of the eruption. Some authorities lengthen this out to three weeks which Ker believes to be entirely unnecessary and he thinks, in the case of adults, that the period might be shortened to ten days in case of need. The incubation period of measles is usually eight, nine, or ten days after the beginning of symptoms and from thirteen to fifteen days to the appearance of the rash. Just how far one might be justified in using a part of this incubation period to save school time is, of course, a matter for discussion. Eberstaller, at Graz, and Widowitz allow contacts to attend school for eight days and close the infected class from the ninth to the fourteenth day.

<sup>1</sup> Edinburgh Medical Journal, January, 1914, p. 6.

**RUBELLA.** Ker detains German measles in the hospital for ten days, but, if the disease occurs in other wards, a shorter time is recommended and he believes that Goodall's recommendation of seven days from the appearance of the rash is ample. As regards school children, he believes that contacts could safely attend school for eight or nine days after exposure, and after that should be excluded until the twenty-first day has passed.

**WHOOPIING COUGH.** Ker believes that the detention of whooping cough cases in hospitals is of great advantage to the patients themselves as it lessens the mortality, and, for this reason, he prefers to see the time limit of the hospital care extended rather than diminished. He believes, however, that the great infectivity of whooping cough is in its prodromal catarrhal stage. He has noted, and this is an experience of perhaps most of us, that a patient who has been a week or two in a ward and suddenly commences to whoop, will probably have infected a number of other patients. Ker noted, some years ago while working under crowded and inconvenient conditions in an old hospital where isolation wards did not exist, that children admitted in the paroxysmal stage and left in very close contact with susceptible subjects did not appear to cause any infection. He teaches, therefore, that there is but very little infectivity after the patient commences to whoop. This is also the teaching of Henoch, and similar views are held by Czerny. In France, Weill treated 29 cases of whooping cough in the children's ward at the Charité, in Lyons. During the time the patients were in the wards, 338 susceptible children were also treated and not one of these contracted the disease. All of the whooping cough patients were admitted in the paroxysmal stage.

**MUMPS.** The usual period for mumps is three weeks, and Comby makes it as long as from twenty-five to thirty days. Ker believes that patients may be allowed out of isolation after one week has elapsed after the disappearance of the swelling. The question of school and contacts he believes to be settled by excluding contacts from the thirteenth to the seventeenth day from the date of the last exposure respectively.

**The Newer Bacteriology of Infections.** Until very recently bacteriologic studies have been carried out by working only with the fluids of the body and the semi-fluid exudates. In the ordinary acute infections the older methods have given satisfactory results, but in many chronic diseases it is impossible to demonstrate bacteria either in cultures or in the tissues by using the older methods.

Rosenow<sup>1</sup> has given us the results of some studies made in excised tissues from the blood and other fluids. He used a special method of taking cultures from the tissues, and has paid especial attention to the

<sup>1</sup> Journal of American Medical Association, September 12, 1914, p. 903.

primary cultures, and particularly to the question of oxygen pressure. The tissues are removed with the usual strictly aseptic precautions, the operation generally being done under local anesthesia, and the cultures made at once. However great the care taken to avoid contamination, the surface of the part used for cultures is sterilized by dipping it into boiling water, or, even better, by putting it into a vigorous Bunsen flame, or by searing it with the heated blade. The tissue is then rapidly cooled in sterile salt solution, and a special apparatus has been devised to mash the tissue and make it into a fine emulsion under perfectly sterile conditions. Blood cultures have been made by taking from 15 to 30 cc. of blood withdrawn from the veins at the bend of the elbow and decalcifying it by adding 1 cc. of a 2 per-cent. sodium citrate in sodium chloride solution for each 5 cc. of blood. It has been shown by experiment that bacteria in the blood will live in this solution for at least seventy-two hours.

The various methods of taking cultures have been employed, and, owing to the power of the cells to consume oxygen, the bottoms of the tubes of cultures continued anaërobic, while the top of the tubes remained aërobic. The space between represents a gradient of oxygen pressure between two extremes. Where small amounts of tissue are used, pieces of sterile rabbit or guinea-pig tissue are added to the bottom of the tube if strictly anaërobic conditions are desired. These methods are essentially the same as those employed by Theobald Smith, and Noguchi, but Rosenow's methods permit of a study of cultures and their ability to grow at different points in the tubes which are under different degrees of oxygen pressure.

A series of interesting results have been obtained by the use of this method: From the blood of Hodgkin's disease, a diphtheroid-like organism has been isolated, and this same organism from the blood, as well as from the nose, in two or three cases of erythema nodosum. Diphtheroid bacilli have also been found in the blood in 4 cases of severe infections resembling rheumatism, and in 54 cases of arthritis deformans one or two lymph nodes draining the joints have been examined and in 32 cases a non-hemolyzing streptococcus resembling in most particulars the streptococcus viridans, 5 times the bacillus mucosus, 3 times the micrococcus catarrhalis, and the gonococcus once; the bacillus welchii in 14 cases, and a diphtheroid bacillus in 5. In 7 cases, the cultures remained sterile. In both rheumatic and deforming arthritis the same organisms have been separated simultaneously, either from the fluid or capsule of the joint, and the excised lymph node.

From the tissue around duodenal and gastric ulcers, a non-hemolyzing streptococcus has been obtained in 16 out of 21 cases, and the same organisms from the smaller lymph nodes near the ulcer in 4 out of 5 cases. In 16 cases, a staphylococcus-like organism was present, usually in small numbers. Rosenow believes that these organisms,

particularly the streptococcus, are probably not secondary infections, but important etiologic factors of the various conditions named. His reason for believing this is that strains from rheumatism, if injected directly, usually set up endocarditis, myocarditis, and pericarditis; strains from arthritis deformans set up arthritis and myositis, but rarely endocarditis or pericarditis. Those from the depths of the ulcers of the stomach often show a striking affinity for the mucous membrane of the duodenum of dogs and rabbits, while those from the gall-bladder and gall-stones commonly produce cholecystitis.

In addition to this, it has been shown that bacilli from erythema nodosum, when injected as isolated, show a marked affinity for the subcutaneous tissue in animals used for purposes of demonstration, that is, dogs, rabbits, and guinea-pigs, producing localized hemorrhages followed by infiltration resembling the nodes seen in man, the lesions often being symmetrically placed, and usually near a relatively large bloodvessel. It is interesting to note that this property is lost either in passing through animals or after artificial cultivation. In both instances the organism tends to become a streptococcus acquiring an affinity for the joints, fascia, muscles, and endocardium.

**Heart Disease and Infections.** In this connection, it is interesting to note the observations of Cabot,<sup>1</sup> who analyzed 600 cases with failing heart; 8 accompanied goitre, and 300 were doubtful. Of the remainder, 170 could be classed as rheumatic, 22 as syphilitic, 40 as arteriosclerotic, and 58 as nephritic.

Under the rheumatic heading are grouped cases of adherent pericardium, and a valvular disease, associated with acute non-gonorrheal polyarthritis (rheumatic fever); chorea, of the Sydenham type; acute tonsillitis; and primary endocarditis with a negative Wassermann reaction. It seems that the streptococcus alluded to above may be responsible for acute rheumatism, chorea, endocarditis, and tonsillitis depending upon the chief focus of infection. It may start in one place, and later involve other organs, or it may attack several organs at the same time. In 60 per cent. of the cases studied by Cabot, the disease began before the twenty-second year, and usually in the joints; the patients generally died from an infection and rarely from a mechanical or heart death. In his series of cases, women were affected nearly twice as often as men. On the other hand, of the 74 syphilitic cases, 70 per cent. were in men, and only 30 per cent. in women. This form of infection is more apt to affect the heart in middle age, the average age being forty-seven years, and aortic regurgitation usually results. In practically all of the cases in which there is a stenosis of one of the valves, rheumatism or the streptococcus referred to is given as the cause.

Cabot believes that the whole subject of affections of the heart

<sup>1</sup> Journal of American Medical Association, October 24, 1914, p. 1461.

will be put upon a much more rational basis if the terms myocarditis, aortic regurgitation, and the like are discarded, and the type of infection causing the disease or the tissue change which causes it be used in place of these. Or else, it would be well, and this is really the better suggestion, to qualify them with an adjective, such as syphilitic myocarditis, aortic regurgitation, or rheumatic mitral stenosis, etc.

**The Alien in Relation to the Spread of Acute Infectious Diseases.** While the quarantine stations are primarily instituted for the purpose of excluding the quarantinable diseases, the danger of the spread of the common infectious diseases by steerage passengers should not be overlooked. In the larger quarantine stations provisions are made for the detention and care of patients suffering with quarantinable diseases, but measles, scarlet fever, and similar infections are not quarantinable, and ships having cases of these diseases on board may enter port without detention. Williams<sup>1</sup> has considered this subject in a timely article, and he believes that diseases like scarlet fever, originating within the national borders should be under the jurisdiction of state and municipal authorities, but that the National Government should extend its control over incoming cases so as to lessen the danger of the spread of these diseases.

The fate of passengers suffering from one of these infectious diseases varies. If they are citizens, they have the right to land and come at once under the jurisdiction of the local authorities. If they are aliens, they fall into the hands of the officers of the Public Health Service, or at any rate, in most parts this is their fate. In New York, such patients are transferred to the immigrant contagious hospital at Ellis Island. There is no provision for the detention of immigrants who have been exposed to contagious diseases, so that a large number of contacts are allowed to enter the United States and are scattered broadcast over the country.

On shipboard, the care of the sick is practically under the control of the steamship companies, and varies greatly. As a rule, the better companies isolate the cases which occur, either in a space provided for the purpose, or in temporary quarters. But no matter whether precautions of this kind are taken or not, there is ample opportunity for the spread of any infectious disease.

In New York, patients with various infectious diseases are transferred on barges provided by the steamship companies, formerly there being only one compartment for isolation, at present there are two. This gives rise to a considerable number of cross-infections. With a view of estimating the number of infectious diseases developing in Ellis Island among detained immigrants, a study was made of the records for the year ending June 30, 1913. Scarlet fever and measles were the only ones studied, inasmuch as the incubation period is better

<sup>1</sup> New York Medical Journal, June 20, 1914.

known in these diseases. All cases of measles developing within fourteen days after arrival were classed as secondary cases, as cases receiving infection on shipboard, and all cases of scarlet fever developing within seven days were also classed as secondary to ship infection, whereas all cases of measles developing fourteen days after arrival, and cases of scarlet fever developing seven days after arrival, were regarded as having been infected while undergoing detention at Ellis Island.

In regard to measles, the total number of cases admitted to the hospital during the year was 854; 576 were taken from ships on their arrival, and 258 developed at Ellis Island among detained immigrants. One hundred and sixty-seven of these cases developed within fourteen days, were classed as secondary to cases on shipboard, while 91 developing fourteen days after landing, were regarded as being due to infection subsequent to their arrival. Thirteen per cent. of the immigrants arriving during the year were detained for one or more days after their arrival, while 87 per cent. were landed at their arrival, and proceeded on their way to their destinations in various parts of the country. It is fair to infer that a proportionate number, or approximately, 1117 cases developed among the 87 per cent. who were immediately discharged. These are conservative figures, as most of the immigrants were detained for only a day or two, and the 167 cases would not represent the secondary cases occurring among the 13 per cent. detained at Ellis Island. It is safe to say that more than 1000 cases of incubating measles pass through Ellis Island each year.

As regards scarlet fever, of 162 cases, 62 were received from the ships on their arrival, and 100 developed at Ellis Island. Sixty-seven developed within seven days, and the infection may be regarded as occurring at Ellis Island. Fifty-six secondary cases occurred among the 13 per cent. of immigrants who were detained, and a corresponding number of these cases would be approximately 375 cases of scarlet fever. Among 22 cases, there was no record of any primary case of scarlet fever on shipboard, although, in 13 instances, measles was reported.

A somewhat similar state of affairs exists concerning cerebrospinal fever, 32 cases of which were treated during the year at Ellis Island; and of diphtheria, of which 15 cases were treated there.

The remedy for this would seem to be to minimize the chance of contact between the sick and well as it would be manifestly impossible to detain an entire shipload of immigrants during the incubation period of the various diseases. The prevention, therefore, would consist in early detection of contagious diseases on shipboard, and the immediate isolation, together with the subsequent disinfection of the ship's hospital and steerage. The second requirement would be the transference under sanitary conditions of patients suffering from infectious diseases, and the third would be an improvement of the conditions in the detention

rooms. The taking of temperatures of all children under ten years of age in detention rooms would result in the diagnosis of many cases. All children with temperatures should be sent to the hospital, and placed in the observation wards. During a period of a little over two months, 116 cases of fever were detected, 72 of which proved to be non-infectious diseases. There were 44 infectious diseases, chiefly measles.

**The Use of Mercury in Infectious Diseases.** Various antiseptic drugs have been suggested as a cure for the various diseases caused by vegetable parasites. The most promising of these is phenol, which has been used with remarkable success in tetanus, and various preparations of mercury of which Baccelli has used the bichloride of mercury in the treatment of acute rheumatism as noted in *PROGRESSIVE MEDICINE* of last year. Various other salts of mercury have been tried, and among the enthusiastic supporters of this method of treatment may be mentioned B. L. Wright,<sup>1</sup> one of the surgeons of the United States Army. His preference is for the mercuric succinimide. Wright has contributed a number of articles on this subject which have not attracted much attention and though he probably claims too much for his method, the results which seem to have been obtained are too promising to dismiss without further investigation. The following list of diseases have been treated and these show the class of cases in which Wright believes that the administration of the drug will prove efficacious:

Croupous pneumonia . . . . .	9
Bronchopneumonia . . . . .	5
Typhoid fever . . . . .	5
Epidemic catarrh . . . . .	5
Follicular tonsillitis . . . . .	13
Cystitis . . . . .	1
Furunculosis . . . . .	10
Colon bacillus infection . . . . .	32
Gonorrheal arthritis . . . . .	23
Vincent's angina . . . . .	1
Cellulitis . . . . .	2
Lymphangitis . . . . .	2
Infection incised wound . . . . .	1
Acute miliary tuberculosis (pulmonary type) . . . . .	1
Chronic pulmonary tuberculosis . . . . .	2

To give the greatest service, the doses must be large and injection made in the early stage of the disease. Numerous other observers have experimented with injections of mercury. Souligoux reported 144 cases of puerperal sepsis, with but 5 deaths. Krohl has also made a report upon the use of soluble salt of mercury in infections. Quincke has suggested that mercury be used in cerebrospinal fever, and, as mentioned above, Baccelli has been an advocate of the drug in acute rheumatism.

<sup>1</sup> Medical Record, July, 1914, p. 49.

The amount of mercuric succinimide injected has varied somewhat, the average dose being from one grain to a grain and a half. These injections have been repeated two or three times within two or three days, in case the first injection did not show the amount of improvement that might have been looked for. Care should be taken not to produce mercurial poisoning by repeating the injections too frequently.

**Court Decisions Relating to Morbidity Reports.** Curiously enough, there have been comparatively few court decisions bearing upon the reporting of infectious diseases. This is probably due to the fact that the laws requiring notification of such diseases have been enacted within comparatively recent times. An unsigned article<sup>1</sup> dealing with this subject discusses a number of the court decisions which are not without interest. It is argued that when the penalty is imposed upon a physician for not reporting an infectious disease, the appeal is rarely taken on account of the publicity which it gives to the fact that the physician has violated the law. The small fines usually imposed make the expense of an appeal seem very large in comparison to the loss sustained by paying the fine, and this is indeed so when one considers not only the lawyer's fees but the loss of time and the anxiety of a court case. The experience of the various courts shows that the constitutionality of reasonable laws, ordinances and regulations requiring the notification of infectious diseases is well-established, and that the reports must be made within the time and in the manner required by the law. It is very interesting to note the fact that when the law requires a physician to report cases, he is protected in the performance of that duty, and if he reports in good faith a patient suffering with a contagious disease and that patient is subsequently removed to an isolation hospital, the patient cannot recover damages, even if it is later proved that the diagnosis was incorrect. It is interesting to physicians that the courts have uniformly held that the physician must report the disease according to the regulations or laws. In one instance in Connecticut in which the physician did not report a case of diphtheria, the appeal was based on the argument that it was unjust and unreasonable, inasmuch as it took professional knowledge for which it paid nothing, interfering with the physician's lawful business and imposed a public burden upon a class. The court ruled otherwise and said:

"The inequality of burden of which the defendant complains is only in seeming. Persons offering their services to the public as healers of disease and requiring pecuniary compensation therefor, thereby assert their ability to detect the presence of it when the great mass of the people cannot. The people accede to the truth of their assertion, and, in the matter of life, surrender themselves to their keeping. Of course an ordinance in the interest of life must detect the presence of a

<sup>1</sup> Public Health Reports, July 3, 1914, p. 1754.

fatal contagious disease at the earliest possible moment. Therefore with impartial action it compels that member of the community who is the first to have sight and knowledge of it to give note of warning to others from whom its presence is hidden. It would be idle to require, indeed there would be danger in accepting, this service from those who can not see or do not know. The burden is made to rest upon every member of the only class which is in a condition to contribute anything to the accomplishment of the purpose of the ordinance."

**Bacillus Carriers in Animals.** This subject is attracting some attention in the diseases of animals, and Rettger,<sup>1</sup> working with Kilpatrick and Jones, has demonstrated the fact that the small female chick may act as a carrier of the bacilli of so-called white diarrhea. This disease has previously been studied by Rettger and it was found that the organism, the *Bacillus pullorium*, infected the ovaries, and that it is transmitted in the egg to the growing chicken. In Rettger's studies among infected chickens, it was found that as many as 25 per cent. of the chickens were carriers of this bacillus. It is highly probable that this same line of investigation will be undertaken in regard to other animal diseases.

**The Use of Radium in Infections.** There have been a number of reports in the past few years dealing with the effect of radium emanations on the growth of microorganisms, and also upon infections in the human body. The state of our knowledge is far from satisfactory. Certain observers have found that the alpha-rays exert a certain inhibiting power, but this has been questioned by a number of observers, including Lazarus and Loewenthal. Whether the rays have any influence upon the common pathogenic organisms in the body or not, is still a moot point. Von Klecki believes that if there is any influence it is due to the stimulation on the phagocytic power of the white-blood cells. Radio-active substances have been used in acute and chronic suppurations, and favorable reports have been made on conjunctivitis, chronic ulcers, sinusitis, and the like. Whether or not they have any influence in tuberculosis is very doubtful. Several favorable reports have been made by Bernheim and Neusser who have used the emanations in tuberculous peritonitis, and various authors have experimented with the effect of radium and thorium rays in pulmonary tuberculosis and tuberculosis of the larynx. Most of the authors who have had an experience with radium in the treatment of tuberculosis are of the opinion that, if it is used at all, it should be employed with the greatest care.

**The Prevalence of Infectious Diseases in the United States.** One cannot, of course, get a very accurate idea of the number of cases of infectious diseases in the United States owing to the still very incomplete returns that are made to the health officers, but some very interesting figures

<sup>1</sup> Storrs Agricultural Experimental Station, Bulletin 77, 1914, p. 263.

have been published<sup>1</sup> covering the year 1912 and the first six months of the year 1913. The highest case rate per 1000 inhabitants for measles was 7.892 for Utah, while in New York the rate was 6.854, while the highest fatality rates were reported in Minnesota and Oklahoma both of which were slightly over 4 per cent. This may, however, be due to the fact that cases are rather incompletely reported. Contrasted with this are the low fatality rates in Utah of 0.35 per cent. and in Maryland with a rate of 1.2 per cent. It is quite probable that these low case fatality rates indicate an unusually incomplete notification of cases rather than a low virulence of the disease. These rates are particularly interesting in view of the fact that text-book statements regarding the fatality of measles are quite different, it generally being placed as from 5 to 50 per cent., and these statements are probably based on hospital experience.

The occurrence of poliomyelitis shows that an unusually large number of cases occurred in various parts of the country. In New York State there were 1108 cases reported, in Illinois 480 cases, in Virginia 229, and in Massachusetts 169. The highest fatality rates were reported in Maryland, exclusive of the city of Baltimore, with a rate of 50 per cent., Iowa with a rate of 48.5 per cent., Massachusetts with a rate of 45.7 per cent. In these cases it is quite probable that the incomplete reporting of the disease has much to do with the high rate and yet, in my own experience in Maryland, the disease was unusually fatal during the period under consideration.

The highest case rates for scarlet fever per 1000 inhabitants were reported from Utah with a rate of 25.92, and Illinois with a rate of 20.51, while the highest fatality rate was 11.11 per cent. in Hawaii; 8.9 per cent. in Arizona, and 8.03 per cent. in Wisconsin. Tuberculosis showed a high case rate of 4.338 in Maryland (exclusive of the city of Baltimore) and 3.362 in the District of Columbia, while the lowest rates were from Oklahoma 0.582, and from Kansas 0.624. Typhoid fever was present in Maryland with a rate of 23.87 which is the highest rate for the United States, while Virginia came next with a rate of 28.54. The lowest rates are reported from Minnesota, Wisconsin and Oregon which are a trifle over 0.4 per cent. These low rates are probably due to incomplete reports. The highest case fatality rates were from Wisconsin with a rate of 28.99 per cent., and Kansas with a rate of 27.5, and Minnesota with a rate of 26.68 per cent. These high rates probably are not due to any unusual virulence but that all cases are not reported, and for the reason of rather complete reports the low fatality rates came from Virginia, 6 per cent., and Maryland 12.75 per cent. If it is ever possible to get complete returns, much could be done in stamping out, or, at any rate, in minimizing the various diseases by concerted work.

<sup>1</sup> Public Health Reports, January 16, 1914, p. 111.

**The Actinomyces-like Granules in Tonsils.** In the crypts of the tonsils one commonly finds masses of gray and yellow material varying considerably in appearance. They are said to consist bacterially of epithelial debris, and, if they are examined carefully, it is seen that they are not all alike. Some are small, grayish masses of desquamated epithelium, others are composed of soft, yellowish, pasty material with but very few bacteria, and sometimes there are small abscesses which contain thick pus. Davis<sup>1</sup> has described another variety consisting of small grayish bodies rather brittle and which show, on examination, a ray-like structure resembling in some respects the granules of actinomyces. These structures bear only a very superficial resemblance to the granules of actinomyces and really belong to a different group. As early as 1881, Johne noted these bodies in the tonsils of pigs but it was not until 1896 that Ruge called attention to the same structures in human tonsils. He pointed out that the bodies were not stained by the Gram method which stains real actinomyces. Various other observers describe these bodies, and, in 1906, Miodowski pointed out that these granules have nothing to do with real actinomyces. Davis has made a careful study of these granules and in an examination of 122 pairs of tonsils, mostly from children, they were found in the crypts in 30, and when present were usually found in both tonsils. There are four kinds of organisms always present; cocci, bacilli, spirilla, and filaments. The entire granule, when injected into rabbits and rats, rarely produces abscesses, and it is very probable that symbiotic relationship exists between the cocci, spirilla, and bacilli. These granules are frequently confused with actinomyces, and Davis, after a careful examination of the literature, does not believe that there has been as yet an authenticated case of actinomyces of the tonsil.

**Oral Entamebas.** There has been some interesting work done on the subject of parasitic amebas of the mouth. Smith and Barrett<sup>2</sup> having shown that there is an important relation between these organisms and pyorrhea alveolaris, or Riggs' disease. They have also shown that by the use of emetine these organisms may be killed, and that there is a subsequent improvement or cure of the lesions of the gums. They found chiefly a species of organism corresponding to the *Entameba buccalis*, Prowazek. In two of their cases, the organism was apparently the *Entameba kartulisi*, Doflein, and they think it is probable that at times a third species is also present.

The fact that these parasites occur in the mouth has been known for some time, but they have always been regarded as harmless organisms in this locality. Chiavero, in July, 1914, read a paper on this subject before the American Dental Society of Europe, and he found the parasites in 22 cases of Riggs' disease, but he believed that they had no

<sup>1</sup> Journal of Infectious Diseases, January, 1914, p. 144.

<sup>2</sup> Dental Cosmos, August, 1914.

pathological significance, but, rather, were beneficial, in that they fed on the parasites of the mouth, and so tended to disinfect it. In 46 patients examined by Barrett, amebas were present in every instance. Seven cases of normal gums were examined, as a control, and found to be free of these organisms. Thirteen of these cases were treated with injections of emetine, and all of the patients recovered.

Bass and Johns<sup>1</sup> examined 87 cases, and found ameba in 85. They also had good results with the use of emetine administered hypodermatically. The use of this drug locally is also followed by good results.

Smith, Middleton, and Barrett<sup>2</sup> made a study of the tonsils in relation to this parasite, believing that they might be invaded from the pockets in the gums. The first specimens examined were tonsils that had been freshly excised, and 5 out of 17 cases showed the presence of *Entameba buccalis*, Prowazek. The scrapings made of the material from the tonsil crypts did not show any of these parasites, but subsequent examination of the semifluid material, drawn out by means of a fine pointed glass pipette from the deep crypts, sometimes showed the presence of the organisms. In 6 patients suffering with chronic arthritis, entamebas were found; in 4, in the tonsils. Three additional cases of a similar nature, observed by other physicians, are reported with these.

From this amount of clinical material, it does not seem possible to draw any definite conclusions regarding the possibility of amebæ causing chronic arthritis through the absorption of toxic substances produced by them, but it would be exceedingly interesting to have a large series of chronic joint infections studied with this point in view, and it would also be of great interest to have therapeutic tests made in the cases in which the amebæ are found.

The use of emetine in Riggs' disease can certainly be recommended, and a more extended trial will soon prove whether or not the results claimed for it can be uniformly obtained.

**The Experimental Transmission of Anthrax.** There are very few records of experimental work that has been done with an attempt to demonstrate that anthrax is disseminated by means of suctorial insects. A note of some interest upon this subject has been made by Mitzmain.<sup>3</sup> He made a large number of experiments, only three of which were positive. The reason that the experiment fails so often is probably due to the fact that it is not until the peripheral circulation of the infected animal becomes filled with large numbers of anthrax bacilli that the insect drawing the blood can get a sufficient number to transmit the disease. In the first trials, even though the anthrax bacillus could be obtained in cultures from the peripheral blood, there was no transfer of infection through fly-biting and only negative results were obtained

<sup>1</sup> New Orleans Medical and Surgical Journal, 1914, p. 456.

<sup>2</sup> Journal of the American Medical Association, November 14, 1914, p. 1746.

<sup>3</sup> Public Health Reports, January 9, 1914, p. 75.

when it was aimed to demonstrate the possibility of transmission from animals recently dead of the disease. The successful transmissions were made with an artificially infected guinea-pig which died of the disease on the third day. The flies were applied two and a half hours to a few minutes before the death of the animal. The insects used were the stable fly, *Stomoxys calcitrans*, and the horse fly, *Tabanus striatus*. These insects were then allowed to bite other guinea-pigs. With both species, the infection was successfully transferred even when the flies were interrupted while feeding on the sick animal. The stable flies were transferred to the healthy animal with only a few seconds interval after biting the infected host, and in the other instance an interval of ten minutes elapsed between the feeding. Essentially the same results were obtained when horse flies were used. It was found that the stable fly would harbor the bacilli for from fourteen to seventeen days. Further experimentation will be needed to see what the limits of the transmissibility of this disease are, and it is quite probable that a certain number of unexplained cases of the disease are the result of insect bites.

**The Etiology of Arthritis Deformans.** The association of joint changes with chronic infections is well known. It has occurred to Rosenow<sup>1</sup> to make a study of the lymph nodes draining affected joints. He studied 38 cases, and, in 3 cases of arthritis deformans, the duration ranged from two to seventeen years. From 35 of these he was able to demonstrate certain organisms. In 14 streptococci, the bacillus welchii in 9 cases, staphylococcus in 3, bacillus mucosus in 1 case, and the gonococcus in 1 case. In some cases the same organism has been isolated at the same time from more or less widely separated regions, as from the epitrochlear and femoral glands and joint fluid from joint capsule. A study of the microscopic sections of atrophic tendon and muscles and of the thickened articular capsule in a number of these cases has shown a marked thickening and not infrequently a complete plugging of the bloodvessels, apparently not the result of organized thrombi but rather of primary endothelial proliferation. The patients from whom the organisms have been taken often show great sensitiveness to injections of killed organisms, and sometimes marked improvement has followed such injection.

**Intussusception Due to the Ascaris.** There have been a great many remarkable pathological conditions brought about by the presence of round worms, and there have been numerous examples of lesions of the intestines due to them, including inflammation of the appendix, intestinal perforation, and intestinal obstruction. Numerous instances have also been recorded as to their forming large masses, which have led to errors in diagnosis.

<sup>1</sup> Journal of the American Medical Association, April 11, 1914.

Novorro<sup>1</sup> has published 2 cases of intussusception due to these parasites which are well worth recording. The first was that of a boy, aged five years, who swallowed a pin 7 cm. long with a glass head. The pin was located by a radiograph near the cecum, and an abdominal section was made in the median line just below the umbilicus, and it was found that the entire small intestine below the duodenum was full of ascarides. They were present in such large numbers as to give the impression that the intestine was a cord with a fluted surface. There was an invagination of some 5 to 6 cm. in length, and just above this was a large mass of round worms. This was evidently of very recent origin as there was no change either in the mesentery or in the intestines. This condition was relieved and the pin removed by cutting into the cecum, and the little patient eventually made a good recovery, after having passed enormous numbers of worms.

The second case was that of a child, aged fourteen months, who had been ill for two months. During the last week of illness the appetite was wanting, she was constipated and feverish. Following purgation, there was a small amount of blood in the stools. The abdomen was tender, and, in the hypogastric region, there was a large hard, somewhat movable mass. Diagnosis was made of intestinal intussusception, and there was found to be an invagination under the cecum of about 3 to 4 cm. in length. The appendix was not visible, but was included in the invaginated mass. It was found to be somewhat inflamed, and was removed after the reduction of the intussusception. Round worms were also found, but not in such large numbers as in the preceding case. This patient also made a good recovery. It is probable that both of these instances of worms causing the irregular condition of the intestines were somewhat similar to that instance in which only two worms were found, and which has been related by Schval.<sup>2</sup>

**Death Caused by the Ascaris.** There are a great many different opinions concerning the seriousness of the infection of children with the ascaris lumbricoides. As a rule the infections are not serious, and the parasites either leave without causing much disturbance or else their presence is noted and measures are taken to rid the body of them, but it occasionally happens that the worms may be present in such numbers as to cause difficulty mechanically, either by their presence or by injuries which they cause. Occasionally they produce extreme symptoms from their toxic action. Enernaó<sup>3</sup> reports a fatal case which was a combination of toxic action together with an obstruction in the intestines. He is inclined to believe that the chief trouble was due to the intoxication which was very marked, and which was present before the symptoms of intestinal obstruction became evident. The child was about ten years of age and for some days it had severe abdom-

<sup>1</sup> Il Policlinico, March, 1914.

<sup>2</sup> La Semaine Médicale, 1914.

<sup>3</sup> Il Policlinico, Sezione Pratica, February 1, 1914, p. 163.

inal pains and vomiting, and discharged a number of worms both from the mouth and the rectum. The child had been given in its home certain vermifuges and two doses of castor oil. When the child was seen there was no fever, the pulse was 120, and the condition suggested that of typhoid fever. The tongue and teeth were coated, and the abdomen was somewhat distended and there was intermittent pain and some vomiting. On the following day the general condition was somewhat improved; there was less pain and vomiting, and less distention of the abdomen. There had been noted on the day before, just under the umbilicus and somewhat toward the left, a cylindrical swelling about 5 centimeters in diameter and 15 centimeters long; on the following day the swelling had remained unchanged and the general condition was somewhat worse, and the symptoms of intestinal obstruction were at this time quite clear. An effort was made to improve the condition by the use of a large enema, but without effect. The patient was then removed to the hospital where, owing to the fact that the symptoms of obstruction were not complete and the child was in a grave state of intoxication, the same treatment was continued. This was without effect; an operation was performed and two large masses of worms removed. The condition was not improved by the operation, the child continued to discharge worms both from the mouth and from the anus, and on the following day death occurred. A partial autopsy was obtained, and it was found that large quantities of the parasites were found in small masses scattered throughout the bowel.

**Systemic Blastomycosis.** This condition did not attract much attention until 1907 when Hektoen published a summary of 13 cases. The following year Montgomery and Ormsby made a report, bringing the number up to 22. Stober<sup>1</sup> has continued to study this subject and his report deals with the subsequent history of some of the cases that had been mentioned in the former reports. His article brings the number of cases up to 36, and this rapid increase of the number of cases is without doubt due to the gradual familiarity of the physicians with the disease. The condition is likely to be mistaken for tuberculosis so that undoubtedly many cases are confused with that disease.

The disease seems to be one of early life and of the cases reported, two-thirds have been under the age of thirty-four, the youngest seventeen and the oldest fifty-eight, and all but two have occurred in men. In almost all instances there is a history of hard manual labor and considerable exposure. There is no evidence of any hereditary infections and no instance of definite contagion. Most of the patients have been foreigners, especially Poles and Italians, and nearly all were poor and lived under unfavorable circumstances. In some of the cases there had been a definite injury which may have afforded an opportunity

<sup>1</sup> Archives of Internal Medicine, April, 1914, p. 509.

for direct inoculation or produced a region of lowered resistance for the development of the infection already existing. The cause of the disease is now regarded as a form of mold which has been called blastomycetes. This is found in all the lesions, is easily grown in pure cultures from them, and the disease may be reproduced by inoculation.

There has been some confusion regarding the description and classification of the molds and while the various strains show minor differences, they all present marked similarities. In the tissues, discharges and pus, the organisms appear in pairs or clumps as round or oval bodies and many budding forms. The size of the organism varies, the average is 20 microns in diameter but sometimes they are somewhat larger, and they are often very much smaller, some measuring only from 3 to 5 microns. As a general rule the central part is clear and the capsule refractile. The capsule rarely stains by the ordinary method but the central portion stains with a more or less granular appearance with basic dyes. The organism grows readily in ordinary mediums and growths may be easily obtained on sterile moist bread, fruit, and the like, and it may be easily isolated by making a thin stroke on a dry agar surface. The blastomycetes tends to spread over the surface, making it possible to obtain pure subcultures. In the culture mediums the budding is similar to that which takes place in the body as is noted before or after the appearance of hyphæ and myceliums. The budding is favored by moisture and heat, the other forms of growth by a room temperature and dryness. There are marked variations in the appearance of the cultures, depending upon their age and other circumstances. Stober's article contains rather interesting details and illustrations concerning the growth and characteristics of these organisms.

The possibility of direct *contagion* from cases and cultures is a matter of interest and cannot be settled at the present time. During the spring of 1908, a slight nasopharyngeal infection was present among the hospital attendants, and the throats of 15, who had been exposed directly or indirectly, were examined but no organisms were found in the pharyngeal or bronchial mucus nor could any be obtained by cultures. Strict isolation was not established, but reasonable precautions were observed. There is no record of any one having been exposed to a case getting the disease, and Stober does not believe that infections occur from the organism as it exists in the pus or sputum except by direct inoculation. Whether or not there is danger in handling cultures is a question, and it is interesting to note an incident which occurred during the laboratory work in which a test-tube containing bouillon cultures of blastomycetes was broken in the presence of Stober and another worker. The odor was irritating and it is not improbable that a number of spores were inhaled. In spite of sprays and an antiseptic gargle, a pharyngitis and laryngitis developed in one that was exposed, and the other developed a chill a few hours later and a purulent bronchitis

lasting three days and accompanied by considerable fever. In neither case could organisms be found in films or cultures.

The *source of infection* in many instances seems to lie in the unhygienic surroundings, and molds were often found in the sleeping apartments, and it would seem that, in some of the cases, the portal of entry is through the respiratory tract, and this is based upon clinical and pathological evidence in at least 14 of the cases.

The first symptoms noted were referred to the lungs and, in 11 autopsies in these cases, 9 showed old bronchial pneumonic lesions. There is no very good evidence in man that infection occurs through the intestinal tract. Infection of the skin is of very common occurrence. In many of the cases, infection seems to follow an injury. In 3 instances it has been clearly established that systemic infection followed, and, in these, the cutaneous lesions existed from four to seven years before symptoms of systemic blastomycosis were evident. Dissemination of the skin lesion occurs by spreading through the tissues, or by invasion of the neighboring lymph nodes, and in a few instances from the organisms entering the blood stream and producing metastatic lesions in the lungs. In 2 instances, this seems to have followed directly after the curetting of the lesions. The primary infection of the lungs seems to occur first in the bronchi and is followed by bronchopneumonia. It then appears that the organism spreads through the lymph vessels, producing pleurisy, pericarditis and inflammation of the lymph nodes in the mediastinum. Through these lesions the organism eventually gets into the blood and causes numerous foci throughout the body. There are wide variations in the reaction of the tissue caused by this organism. It may be found without producing any lesion whatever, and in other instances only a slight necrosis is noted. As a rule the infected area shows round-cell infiltrations, either alone or associated with giant-cells, polymorphonuclear leukocytes, or both. In some tissues these lesions resemble those found in tuberculosis, except that the central necrosis is less marked. The main characteristic changes are the cutaneous ulcerations, the deep and superficial abscesses and the more or less tubercle-like nodules. Infections in the skin may appear as pustules, subcutaneous abscesses, or local ulcerations. As a rule, the pustules are multiple and occur in crops. The ulceration may develop in the side of the ruptured abscess or primarily, and sooner or later the ulceration assumes a papillomatous appearance which is more or less characteristic of the chronic blastomycotic infection of the skin. The abscesses may occur under the skin, and may range from minute areas to areas containing a quart or more of pus. Some are associated with pain and inflammation, while others are usually discovered accidentally by the patient. The organism can usually be demonstrated in the pus, either by direct smear or mixture with a 20 per cent. solution of sodium hydroxid. Sometimes

it cannot be demonstrated in ordinary smears, in tissue sections, or by cultures, and in these cases a thin smear may be stained with hematoxylin and eosin, or with polychrome-methylene blue.

In many instances a careful *history* could not be obtained, but, when it could, the illness usually began with a cold or an acute infection of the respiratory tract, the more marked cases being preceded by a chill and followed by pain in the chest, fever, dyspnea, cough, and the expectoration of blood and mucus. Sooner or later, subcutaneous abscesses appeared. In either case the onset was very gradual, and the skin lesions were the first thing to attract the patient's attention. Later, the general symptoms were those of chronic infection, weakness, pain in the lesion, irregular fever, and rapid pulse with occasional chills and sweats. Emaciation was extreme in most cases, especially in the latter days. The temperature was very irregular, but there was generally a rise in the evening, often associated with a sweat. The sputum was generally thick and purulent, and often contained blood. The blood occurred only in small amounts, and no marked hemorrhages were noted. Blastomycetes were found in the sputum of 8 cases and in the mucus removed from the trachea at the autopsy of 2 others. They were also noted in the sputum of 4 other cases. In some of the cases there was hoarseness, the respiration was increased, and dyspnea was also present at times. Some of the patients complained of pain in the chest which was evidently due to pleurisy, but this was not of long duration. Most of the patients complained of a dull, aching sensation in the chest.

The *physical signs* were not characteristic in any way. There was diminished expansion, dulness, presence of rales, increased vocal fremitus, but this did not seem to be as marked as the illness in the lung would seem to warrant. The spleen was not constantly enlarged, intestinal disturbance was sometimes present, and the blastomycetes were at times found in the feces. Nephritis was not uncommon, and in 2 cases blastomycetes were found in the urine, having their origin in the prostate. In 2 instances there were lesions in the spinal cord which caused paralysis of the legs. In 1 case the mold infected the eye, and marked neuralgic pain and gradual loss of vision were the first symptoms noted. In this case the infection was in the posterior chamber and caused adhesion of the iris, irregularity of the pupil, opacities in the cornea, marked congestion of the conjunctiva with purulent discharges.

The *blood examination* showed a lowered percentage of hemoglobin and reduction in the number of red-blood corpuscles. In most cases there was a leukocytosis, sometimes running as high as 30,000. The average differential count was: polymorphonuclears, 73 per cent.; small mononuclears, 17 per cent.; large mononuclears, 6.3 per cent.; transitionals, 0.7 per cent.; eosinophiles, 1.5 per cent.; basophiles, 0.1 per cent.; myelocytes, 1.4 per cent. As a rule the mononuclears were

relatively increased, and this was more marked in those cases in which the leukocytosis was not so high.

The disease may be easily mistaken for other things, perhaps the most common is to confuse it with tuberculosis, which it resembles both clinically and pathologically. In cases suggesting tuberculosis, in which the tubercle bacilli are absent, this disease should be borne in mind, and the sputum examined for the organism. When the disease is in the bones, it is also suggestive of tuberculosis, and several cases of skin infection have been mistaken for lupus.

In some, the pustules and ulcerative lesions may be easily mistaken for syphilis, and the appearance of the bones to the Röntgen-rays is also somewhat similar, and the confusion of the two might be somewhat heightened by the improvement which may follow the use of potassium iodid.

The Wassermann reaction may prove of value in some instances, especially if it is negative. The disease may also be mistaken for epithelioma, the principal points of difference being the slowness of growth of epithelioma and the greater induration, and absence of the bluish-red halo which is found in the blastomycotic cases. The disease also resembles coccidioidal granuloma. This disease resembles it so closely that it requires a trained pathologist to make a distinction. It has been discussed by Hektoen and Ormsby in their article referred to above. It is possible that the blastomycosis vaccine reaction may prove of value in diagnosis. In 3 cases in which there were cutaneous lesions, there was a distinct inflammatory reaction in the local lesion after the injection of vaccine. The other tests, such as the cutaneous and ophthalmic tests, produced no reaction to be considered.

The *prognosis* in this disease is exceedingly grave, the mortality in those cases reported being 90 per cent. although it must be noted that the diagnosis was not made until the patient was in a dying condition and sometimes at the autopsy. The *duration* of the illness has varied from four months to two years, and more than half the patients had the disease for more than a year.

The *treatment* consists of preventing the disease by proper ventilation, lighting, and drainage in living quarters, and by proper surgical care of wounds received in the presence of decaying or moldy wood or other material.

The treatment of the disease after it has developed consists of the use of food, climate and hygienic measures similar to those employed in tuberculous cases, and the use of potassium iodid internally.

The Röntgen-rays have been used with benefit in cutaneous lesions, and, in some instances, surgical operations have been advisable.

The use of vaccines have been tried in 3 cases, 2 of systemic infection and 1 in which the skin was involved. In 1 case, remarkably good results were obtained; in 1 case the result was not favorable. In the

case of cutaneous infection, the result was at first remarkable, but this was only temporary and the patient eventually succumbed.

The observers believe, however, that in vaccine therapy lies one of the great hopes in the treatment of this disease, particularly the earlier cases. The vaccines used consist of a filtrate and a suspension of the triturated membranes of bouillon cultures grown at room temperature for a period varying from two to six months. These were killed by heat ( $110^{\circ}$  C.) and preserved with 0.18 per cent. chloretone.

In the same number of the journal containing the above study, there will also be found a number of other reports, together with instructive photographs of cases of systemic blastomycosis by other authors. Nearly all of the cases occurred in or about Chicago.

**Chicken-pox of the Newborn by Maternal Contagion.** This disease is very rare in the newborn, so that the observation of LeBroutet and Moricand<sup>1</sup> is of particular interest. The mother of the child, on the eve of her delivery, developed a typical varicella of moderate intensity. The child was born on the twenty-seventh of March, and, on the eleventh of April, fourteen days after the birth of the child, developed a typical chickenpox, the details of which are given by the authors but which contain nothing of note. It is interesting to note in this connection that the daily weight curve was apparently affected by the onset of the disease. After the initial loss of weight, from 2675 grams to 2450 grams, the infant remained until the eighth of April without gaining. On the tenth of April it had reached 2500 grams. The gain in weight from that time on was slow but became more rapid after the twenty-eighth of April, after all the symptoms of the disease had disappeared. The authors believe that this is similar to the phenomena observed by Meunier in measles in which there is a well marked loss of weight during incubation. Appert, in 1895, reported an epidemic of varicella in a maternity. His cases developed on the fourteenth, sixteenth and seventeenth days, were all in weak, premature infants, and all ran a very benign course.

**Ship-borne Cholera.** The number of cholera cases and carriers that have arrived in New York from time to time, furnish a text for a lesson in the prevention of cholera. Craster,<sup>2</sup> after outlining the special measures taken by the health authorities and the routine examination of cholera suspects, calls especial attention to the cholera carriers who are probably a great source of danger in spreading the disease. The length of time through which the cholera-bacillus carrier continues to be infective is said to vary. Zlatogoroff has succeeded in isolating the organism from the stools of a person one year after recovery. The great masses of cholera cases seem to be particularly dangerous between eleven and fourteen days, according to Saccone. The majority of the

<sup>1</sup> Archives de Médecine des Enfants, 1914, p. 288.

<sup>2</sup> Journal of the American Medical Association, December 20, 1913, p. 2210.

cases isolated at quarantine remained infected from a few days to two weeks or more, and in one case the cholera-bacillus was present for fifty-four days. In New York, three or more bacteriological findings, at intervals of three days, were required before the cholera carrier was released from detention.

The question of the diagnosis of cholera has come to be largely a laboratory matter, and the finding of the typical cholera-like vibrio in the stool is supplanted by the Pfeiffer reaction in which an emulsion of the suspicious organism is injected into the peritoneal cavity of the guinea-pig together with a cholera-bactericidal serum. When the reaction is positive, the specimen of the peritoneal fluid removed after a few minutes, shows disintegration of the vibrios. The control experiment is made with normal serum. In addition to this test which is specific, the agglutination reaction and the complement fixation test may also be resorted to. The lessons of particular importance to be learned from Craster's article are that when a cholera outbreak occurs and a sporadic case is found, a careful investigation should be made to determine the source of infection and to isolate the cholera carriers if any are located.

**Chorea.** The bacteriology of chorea has been a matter of considerable interest, and various findings have been reported. Generally the reports show a coccus similar or identical with the one described by Poynten and Paine in rheumatism, and this has generally been recovered from the blood or from the nervous system. Collins has reported a case of chorea which was cured by treatment with an autogenous vaccine prepared from a coccus obtained by lumbar puncture.

Richards<sup>1</sup> reported two cases in which the streptococcus viridans was found in the blood. These were made from blood taken from a vein and planted in North's agar. These were incubated at 37° C. and no growth appeared on any plate for eight days, and all showed colonies having the following characteristics: The colonies were uniformly distributed on the plate, from 5 to 19 on a plate, and formed below the surface of the medium in the growths in which there was blood. The colonies and the immediate vicinity were green. In growths without blood, this color did not appear. The colonies were pin-point in size, did not enlarge on further incubation, and caused no hemolysis. When grown in broth, they formed chains of 8 or 10. In litmus milk, they showed acid in ten days but no peptonization. Acid was produced in the following carbohydrate mediums; lactose, dextrose, arabinose, raffinose and sacchrose, but not in dextrin, mannite, and salicin. Inulin was not coagulated after ten days. The coccus stains by the Gram method and is not encapsulated. Control cultures taken from other patients did not show this coccus. This organism

<sup>1</sup> Journal of the American Medical Association, January 10, 1914, p. 110.

is similar to the micrococcus rheumaticus of Poynten and Paine and is culturally identical with the green-producing streptococcus of Shottmueller. These two organisms have been proved to be identical by Hastings and Thro.

From the rather scanty observations that have been made upon this organism one would be inclined to believe that it is capable of producing lesions in the heart, although it will require further experimentation to determine its relation to chorea. From the frequency of this disease, it would seem that it ought to be comparatively easy to get at the facts of the case. It has always seemed to me that chorea was a condition in many cases produced by the same organism as acute rheumatism, but that the same symptom-complex can probably be caused by toxins from other organisms as well. (See the *Newer Bacteriology of Infections*.)

**The Transmission of Dengue.** On account of the close resemblance to dengue and yellow fever, this disease has received a considerable amount of attention. From observations made upon it, we may assume that the disease is infectious, and can be transmitted from one patient to another, but that it is not contagious, that it must be transmitted in some especial manner, and one does not get it merely from being about a case.

The virus is found in the peripheral blood stream of patients, at least within three or four days, and it may be passed through a very fine Berkefeld filter, but there has been no microorganism described. Craig and Ashburn, in the Philippines, and Graham, in Beirut, have made the principal experiments, and found that the disease may be produced by the injection of filtered and unfiltered blood, and that it is transmitted by the mosquito (*Culex fatigans*, Wied). The period of incubation, in experimental cases, averages three days and fourteen hours, and it was found that some individuals are immune.

In order to confirm work that has already been done, Lavinder and Francis,<sup>1</sup> have carried on a series of experiments in the transmission of the disease to rhesus monkeys by the inoculation of fresh defibrinated blood. There have been no trials made, so far as I know, on the subject of transmitting the disease to monkeys, until these experiments. From 3 to 10 c.c. of defibrinated blood from each of 8 cases of dengue were injected into nine rhesus monkeys. The blood was used within two to six hours after the withdrawal in all the cases but one, in which it was kept twenty-four hours in an ice chest. The cases from which the blood was taken were all carefully selected. The monkeys did not show any change in temperature, skin eruptions, or any of the ordinary symptoms of illness. There was some variation in the leukocyte count, which was made because there is a constant and definite leukopenia found in dengue.

<sup>1</sup> *Journal of Infectious Diseases*, September, 1914, p. 341.

The results obtained were not at all positive, but they suggest a repetition, particularly as the authors believe that "the theory of mosquito transmission of dengue can hardly withstand strict scientific scrutiny."

**The House Fly in Diarrheal Diseases among Children.** Numerous studies have been made in regard to the role of the house fly in transmitting diseases but, as a matter of fact, we really have very little definite information on this subject. Most of the studies have been carried out in southern cities, but some work has been done by Armstrong<sup>1</sup> in New York City. He is of the opinion that, until greater attention is paid to the elimination of the fly, the best work will not be done in limiting summer diarrhea.

The work was done in the summer of 1913 in the borough of the Bronx, New York City, in a neighborhood inhabited solely by Italians and presenting typical conditions associated with overcrowded, filthy streets, and the like. One area inhabited by 311 families, or by 1725 individuals, and containing a population of 362 children under the age of five years, was selected. In this area every effort was made to eliminate the house fly and to prevent its contact between filth and food. In another area, containing the same number of families, observations were made under the usual unsanitary conditions. The fly campaign was carried out by nurses in an effort to educate the mother, both by word of mouth, and by frequent distribution of literature and free tickets to a moving picture theatre where an anti-fly picture film was shown. All the doors and windows of the area were carefully screened, and, under the auspices of the local Boy Scout Association, large fly traps were placed in courtways, yards, and stables. In the protected district there were 20 severe diarrheal disturbances, while in the outside district there were 57, or a ratio of nearly 1 to 3. The total number of sick days from diarrheal diseases among infants in the protected area was 153, while of the outside families the number was 984. The conditions in both areas were practically the same with the exception of the fly campaign. It is possible that, in eliminating the flies, the general sanitary condition was improved at the same time. These figures of course are derived from a very small number of people, and the conclusions that one would draw are not by any means conclusive and yet it would seem to point to the fact that the fly plays a large part in the transmission of the diarrheal diseases.

**Diphtheria.** THE SCHICK REACTION AND SUSCEPTIBILITY TO DIPHTHERIA. It has been known for a long time that a certain proportion of children seem to be naturally immune to diphtheria, and it has also been known that very young infants are more or less immune. This immunity has been found to be due to the presence of diphtheria anti-

<sup>1</sup> Journal of the American Medical Association, January 17, 1914, p. 200.

toxin in the blood of these individuals. Whether or not this antitoxin has resulted from active immunity in the ancestors is not known, but there can be very little doubt as to the accuracy of the observation.

The amount of antitoxin in the blood may be estimated by using Römer's intracutaneous method on guinea-pigs. It is not possible by this method to detect less than 1.16 units in 1 c.c. of serum, so that anything under this is considered an absence of antitoxin, although some serums tested may contain amounts smaller than this. Tests for the amount of antitoxin are not practical for routine work, so that the observation made by Schick<sup>1</sup> is of particular interest. He has described a method which affords a way of determining, within certain limits, whether or not a given individual is susceptible to diphtheria. His method is to inject into the skin, not under it, a very small amount of diphtheria toxin, the quantity used being  $\frac{1}{50}$  of the minimum lethal dose for a guinea-pig weighing 300 grams. This is so diluted that it is contained in 0.1 c.c. of fluid. This should be injected with a very small needle, taking care that it goes directly into the skin, the flexor surface of the forearm being generally chosen for convenience. Immediately after the injection, a small, raised, white-looking spot is seen. This varies in size up to an area of about 3 cm. in diameter. If this does not occur, it is pretty safe to assume that the injection has been improperly made. Within twenty-four hours, these areas become somewhat cyanotic, slightly edematous, and reddened. This passes off in forty-eight hours, and that reaction is followed by a brownish pigmentation. This reaction is found only in individuals without natural antitoxin in their blood, and, if such a reaction is positive, it indicates that less than  $\frac{1}{50}$  of a unit of antitoxin is contained in 1 c.c. of blood. Individuals in whom this reaction is positive may be considered susceptible to diphtheria. Children sick with diphtheria give the reaction when tested before having received the antitoxin serum. It is exceptional for the newly born to give the reaction, and it is well known that they are usually immune to the disease.

The results of the observation made by Schick show that 93 per cent. of the newly born are protected by natural antitoxin, 57 per cent. of children in the first year of life, 37 per cent. of children between two and five years, and 50 per cent. between five and fifteen. This method is of particular value in determining the susceptible individuals who have been exposed to the disease, particularly in the case of asylums and schools. The individuals found to be susceptible, and who have been exposed to the disease, may be immunized with the customary prophylactic dose of antitoxin.

These observations of Schick have been confirmed by Park and his associates, as well as by others.

<sup>1</sup> Münch. med. Woch., 1913, p. 2608.

THE ACTIVE IMMUNIZATION IN DIPHTHERIA AND TREATMENT BY TOXIN-ANTITOXIN. For many years it has been known that mixtures of toxins and antotoxins could be used to produce immunity in animals, and there have been a considerable number of reports made from time to time on this subject. As early as 1903, Park made some valuable contributions to this subject, and Theobald Smith suggested the use of this method in producing immunity in children, but nothing was done in regard to its use in adults, until von Behring started his experiments in 1912. His report was made in 1913, and it was followed almost immediately by the reports of Schriver, Zangmeister and Viereck. The results of these studies were noted in *PROGRESSIVE MEDICINE* last year. The observations of the different observers have not been uniform.

In addition to the above, Kissling, at the Hamburg-Eppendorf Hospital, immunized 310 children, all of whom had been exposed to diphtheria. In 111, two injections were given, and no diphtheria developed; in 109 cases, injected once, 8 patients developed clinical diphtheria.

Hahn and Sommer had occasion to use this method in 633 cases living in villages in which diphtheria was epidemic. Ten of these cases developed the disease within ten days, but only 2 developed it after they were considered immune. In this epidemic the disease continued to spread among those not vaccinated.

A number of curious things have been brought out, but the evidence of some of the beliefs will doubtless need revision. Zangmeister believes that the newly born are nearly one hundred times less susceptible to vaccine than adults. The length of time required to develop antitoxin in the body, after the injections of vaccine are given, varies. Kleinschmidt believes, as does Viereck, that it is short, stating eight days as the minimum, while Hahn believes that three weeks probably represents the minimum time. Individuals with natural antitoxin are probably responsible for these differences in observations, as they are known to develop antitoxin earlier than those in whom natural antitoxin is a negligible quantity. It is stated that these individuals are more susceptible locally to vaccines than others, and von Behring believes that this is due to sensitization from previous infections with diphtheria bacilli. He also believes that the high temperature, such as occurs in febrile conditions, causes an increase in the rate of destruction of the antitoxin, so that an amount which ordinarily protects fails to do so in such diseases as measles and scarlet fever.

Park, Zingher, and Serota,<sup>1</sup> have reported their experiences in attempting to produce an active immunity in scarlet fever wards of the Willard Parker Hospital. A large proportion of the patients admitted with scarlet fever were found to be diphtheria carriers, and during the winter it was

<sup>1</sup> *Journal of the American Medical Association*, September, 1914, p. 859.

estimated that an average of one fourth of the patients came under this head. Immunity was produced by the use of a mixture of diphtheria toxin and antitoxin, and this was either slightly antitoxic, neutral, or slightly toxic to the guinea-pig. The injections were made subcutaneously or intramuscularly, and the dose was varied from 0.25 to 1 c.c. of undiluted vaccine. In a few instances of non-immune persons the dose was as high as from 3 to 5 c.c. at each injection. The intervals between the doses varied from three to seven days, and this was repeated two or three times. As a rule, injections were made in the back in the intrascapular region or sometimes at the insertion of the deltoid. There were variations in regard to the reactions which seem to differ with the size of the dose, and the susceptibility of the patient. The local reaction consisted of redness, induration, pain, and tenderness. The local reaction is not intense in individuals showing natural antitoxin; the constitutional symptoms were, as a rule, slight, occasionally a degree or two of fever being noted after the use of the stronger mixtures. The results obtained were controlled by determining the antitoxin content before the injection, and again three weeks or more after the injection. The estimation was made by Römer's intracutaneous method on the guinea-pig. It is not possible, by this method, to detect less than 1.160 units in 1 c.c. of serum, so that anything under this was considered an absence of antitoxin, although some of the serums may have contained amounts smaller than this.

Sixty patients, in all, were used for the injections. In 44 of those who showed, before the injection, sufficient natural antitoxin to protect them against diphtheria, antitoxin was developed with great rapidity, in some as early as seven days. The remaining 24, who showed no appreciable antitoxin before the injections, are to be divided into two classes, 6 showed a rise in antitoxin, while 18 failed to produce it. In 5 of these 18, there was a slight or moderate clinical diphtheria, two or more weeks after the first injection, and from all it was possible to isolate virulent diphtheria bacilli. It will be seen that patients with natural antitoxin respond readily to this method, while others fail in a considerable number of instances.

For the purpose of further study, Schick's reaction was used, and in their study, 90 patients were selected who were found by this reaction to be without appreciable antitoxin. These were given the full immunizing dose. Twenty-two per cent. of these showed a decided production of antitoxin, from 1.2 up to 10 units in 1 c.c. Of the remaining 70, it was found that many gave a fainter Schick reaction, but the amount produced in the blood was too small to be detected by the animal test. Seventeen, of the 70 patients who failed to respond, developed clinical diphtheria twelve or more days after the injection of the same vaccine. Those who showed the disease before twelve days were not included in this group.

It will be noted that in susceptible patients, active immunity may be produced after a period of six or within less than two weeks, and that in the remainder, about 20 per cent. of those exposed to the disease are liable to contract it. In individuals with natural antitoxin, and who may be regarded as immune to diphtheria, the injection caused a decided increase in the antitoxin in a relatively short time.

The Schick test was applied to 700 scarlet fever patients of various ages, and 400 gave a negative reaction; that is, 50 per cent. were naturally protected, and did not need either active or passive immunization. Less than 25 per cent. of the remainder reacted to the diphtheria toxin and antitoxin mixtures to a sufficient degree to immunize them perfectly.

The results of these studies show that individuals who have been exposed to diphtheria infection should receive passive immunization by the use of antitoxin, even if the toxin-antitoxin injections have been used. The Schick test may be used to determine the necessity for immunizing. Those found to be naturally immune probably remain so for a long time, possibly indefinitely. It would be necessary to have further studies made upon active immunization before one can determine of what value it will be. Practically, in the absence of any danger of infection, it may be used to lessen the number of susceptible persons. Orphan asylums and similar groups of children among whom diphtheria is frequent may be immunized by this method with considerable benefit.

**THE DOSAGE OF DIPHTHERIA ANTITOXIN.** There have been a number of contributions dealing with this subject. It is hardly necessary to mention more than one.

Woody<sup>1</sup> has discussed the question of using larger doses, and he, in common with many others, is a believer in massive doses. He believes that the minimum dose should be 10,000 units, but in pharyngeal cases, or cases where the exudate is marked, and of one or two days' duration, the dose should be from 30,000 to 60,000 units, and in cases where the exudate is extensive and of three days' duration or more, he recommends 150,000 to 300,000 units. These large doses may be given if a little care is used in their administration without any more danger than is attendant upon the use of small doses. Woody cites his own results as an argument in favor of these large amounts. His series of cases has varied each year between fourteen hundred and two thousand, certainly a sufficient number for drawing accurate conclusions. In 1908, using very small doses of antitoxin, his death rate was 8.58; the following year, and thereafter, he used larger doses, and his death rate dropped to 6.69; with still larger doses, the following year, the rate dropped to 6.42. With smaller doses, although still large, there was an increase to 6.86, and in 1914, with a return to larger doses, it was 6.02. These differences of less than 1 per cent. one can disregard and undoubt-

<sup>1</sup> Journal of the American Medical Association, September 5, 1914, p. 861.

edly the same results could be obtained by smaller doses, particularly if given earlier or intravenously.

The best method of giving antitoxin is to give whatever dosage is thought advisable all at once, and at the earliest possible moment. A safe dosage is 5000 units in mild cases, 10,000 in severe cases, and 20,000 in malignant cases. Statistics in hospitals where this dosage has been used compare very favorably with statistics taken from hospitals where enormous doses have been given. The idea is to give a sufficient amount of antitoxin to neutralize the toxin in the body. The absorption of antitoxin is slow, so that it takes about two days, according to Park, for one-third to be absorbed, and a couple of more days before the remainder is taken up. As an alternative for giving massive doses subcutaneously, the very much more rational method is to give smaller doses intravenously. Park has found that with this method of administration, maximum results may be obtained by using doses varying between 5000 and 25,000 units, and that only in exceptional cases, if at all, do doses larger than this have any beneficial effect.

*Dosage According to Body Weight.* Schick, Kassowitz, and Busacchi,<sup>1</sup> have made a series of experiments, and believe it is possible to calculate the amount of antitoxin needed according to the body weight of the individual to whom it is to be given. They show by their experiments, the fact that has been shown before, that a sufficiently large dose given earlier is much better than several times the same amount given later in the disease. They believe that the injections should be given at the earliest possible moment, and that it should be injected into the muscles. For the average case of diphtheria, they advise 100 units per kilogram of body weight.

These studies, while very interesting, and while undoubtedly along the line on which future advance is to come as regards the exact dosage of antitoxin, are of perhaps not as great practical importance as they would seem at first glance, inasmuch as we have no available method of determining accurately the severity of the infection. In order, therefore, to be on the safe side, one would give somewhat more antitoxin than would be indicated by these experiments and the dosage outlined above has been found by practical experience to be satisfactory.

RECENT INVESTIGATIONS IN DIPHTHERITIC PARALYSIS. Last year I reviewed the splendid article by Rolleston, which dealt with the clinical side of paralysis of diphtheritic origin. This year, one of the most striking contributions on this subject has been made by Römer and Viereck,<sup>2</sup> who are working in the Institute of Hygiene and Experimental

<sup>1</sup> Zeitschrift für die ges. exper. Med., 1914, p. 83.

<sup>2</sup> Beiträge zur Klinik der Infektionskrankheiten und zur Immunitätsforschung, vol. ii, No. 1.

Therapy of Marburg. In addition to their other work, they have made a study of the relation of the use of diphtheria antitoxin to paralysis, and their findings coincide with those of other observers, in that they find that antitoxin never causes paralysis *per se*. There is an apparent increase in the number of cases of post-diphtheritic paralysis since the introduction of antitoxin, but this is due to the fact that the mortality of diphtheria has been decreased, and many severe cases that formerly died now live, and may have paralysis as a result of their severe poisoning.

They made some experiments on animals, and found that, even when given in small doses, antitoxin tends to prevent paralysis, and if administered within twenty-four hours of the dose of toxin will almost invariably avert it. They did not, however, note any curative effect upon the paralysis that had already taken place. This coincides with the usual impression that antitoxin given early lessens the incidence of paralysis; the earlier, the better, but there is a distinct effect in this direction up until the fourth day. Afterward the incidence seems to be unaffected by the administration of it, except as the antitoxin may save the life in severe cases.

They also found that the most effective way to give antitoxin was intravenously, and that by using this method the effective dose need not be so large. Their investigations in regard to the relation of toxin to paralysis also followed out what is seen clinically, and that is that the early paralyzes are in the muscles or in the nerves situated near the toxin, for example, clinically the soft palate is most usually affected. In experimental paralysis, the location ordinarily corresponds to the site of the injection. Generalized paralysis was always of late occurrence.

They also studied the nature of toxins with regard to the relation of the size of the dose needed to produce death and to produce paralysis. In five different specimens studied, there were found to be marked differences. In one, for example, one seventh of the dose that would cause death would cause paralysis; in the second, one thirteenth; in the third, three-quarters; and in one instance, no paralysis was seen under the lethal dose. It would seem that the power to produce paralysis and to produce death are distinct features, as if the toxin was composed of two different things, which bears out the theory advanced by Erlich, who thought that the paralysis was caused by the toxone, and that the poisoning was caused by toxin. It is supposed that just as we have an antitoxin, so also there may be an antitoxone, just as it has been shown in tetanus toxin that there are two distinct poisons, the one causing spasm, the other the hemolytic action.

Further investigation along this line may lead to a better understanding of diphtheria antitoxin, and, incidentally, of the use of toxins and antitoxins in the treatment of this disease.

THE MECHANISM OF THE CIRCULATORY FAILURE IN DIPHTHERIA. MacCallum<sup>1</sup> made a study of the failure of circulation that occurs in diphtheria. It is well known that in the course of acute infections the patients may die of symptoms somewhat like those of surgical shock. The blood-pressure falls, the pulse becomes weak and small, the skin is pale and cyanotic about the nose and ears, there is often vomiting, the patient breaks out into a sweat and finally the heart stops beating. From clinical observations it has been thought that the trouble was probably one of the vasomotor system rather than of the heart itself. MacCallum's experiments upon dogs, the details of which need not be entered into here, seem to show that the death which occurs in the height of the attack of diphtheria is not exclusively the result of direct injury to the heart although the heart may play some part in the process. The hearts from the poisoned animals are weak and apt to be irregular, but they would continue to beat for several hours after they have shown every sign of failure in the dying animal if the pressure of neutral fluid be maintained in the coronary arteries. As a matter of fact, the animal may be allowed to die and after an hour's time the heart can be revived and will beat for a long time.

DIPHTHERIA WITHOUT A MEMBRANE. It is well known that the diphtheria bacillus at times will cause a catarrhal inflammation accompanied by a membrane. Krobrak<sup>2</sup> has reported a number of instances of suppuration in the nose or nasopharynx which clinically resembles severe influenza but which is really diphtheria and which recovered promptly after the use of antitoxin. He also reports two instances of a vaginal affection simulating gonorrhea which occurred in two girls, aged nine. In both cases there was a marked suppuration, with the usual local symptoms, and the diphtheria bacilli were found in the smears. Prompt recovery took place in both instances after antitoxin was injected.

DIPHTHERITIC VAGINITIS. Goodman<sup>3</sup> has reported an instance of the infection of the vagina with the Klebs-Loeffler bacillus. It is not uncommon to find vaginitis accompanied with membranes, but these are very rarely due to the diphtheria bacillus. The patient was admitted to the medical ward suffering from a lobar pneumonia, and one hundred and twenty days later it was followed by an empyema. On the following day a number of cases of diphtheria were discovered in the ward, and cultures were made of all the patients. The culture from the throat of this patient showed diphtheria bacillus and she was removed to the isolation ward and given 10,000 units of antitoxin. Three days later a foul-smelling discharge was noted from the vagina, and there was found

<sup>1</sup> American Journal of the Medical Sciences, January, 1914, p. 37.

<sup>2</sup> Medizinische Klinik, March 8, 1914.

<sup>3</sup> American Journal of Obstetrics and Diseases of Women and Children, 1914, vol. lxi, No. 2.

to be considerable swelling and a dull grayish membrane. The culture showed a diphtheritic membrane. She had been given 10,000 units of antitoxin and two days later 10,000 more. Twelve days after the removal to the isolation ward, a cast of the vagina was passed, this consisting of diphtheritic membrane. After three weeks, the patient was transferred back to the medical ward but eventually died from edema of the lungs.

There are some 30 cases, more or less, similar to this that have been reported in the medical literature. The condition has been noted in children and even in young infants, many of the cases following immediately after the birth of the child. (See also Diphtheria Without Membrane.)

**TREATMENT OF DIPHTHERIA CARRIERS.** Various suggestions have been made to rid the throat of diphtheria carriers of bacilli, but, up to the present time, no very effectual method has been suggested that was not objectionable in one way or another. Miller<sup>1</sup> has treated a small series of 7 cases by spraying the throat with a solution varying in strength from  $\frac{1}{4}$  to 1 per cent. of the usual 40 per cent. formaldehyde solution. The patients' throats were sprayed one hour before and two hours after the ingestion of food or fluid, and it was usually done every three or four hours, except during sleep. Test cultures were taken from five to eight hours after the solution had been used. He found that the best results were obtained by using the solution warm, or almost hot, so he advises that the solution be prepared fresh daily, and warmed in a corked bottle before using. From three to six days were required to free the throat from bacilli.

This method is worth bearing in mind, inasmuch as Miller found some cases in which it acted favorably, where the other antiseptics, ordinarily used, had failed, and also where an emulsion of the staphylococcus aureus had been used without success.

**THE STAPHYLOCOCCUS SPRAY IN THE TREATMENT OF DIPHTHERIA.** In an epidemic of diphtheria in New Castle, Pennsylvania, Womer<sup>2</sup> had occasion to observe the effect of the staphylococcus spray on ridding the throat of diphtheria bacilli. In this epidemic there were 125 clinical cases and 90 healthy contacts. Eighty per cent. of the clinical cases, and 77 per cent. of the healthy contacts, showed positive cultures at the end of thirty days, and some longer. No cultures were taken after this was done, and, even though the organisms were present in the throat, the children were allowed to attend school. It would seem that in these cases the bacilli had lost their virulence as they did not appear to have spread the disease. In order to lessen the period of quarantine, the author resorted to the use of *Staphylococcus aureus* bouillon culture at least twelve hours old or a fresh suspension in salt solution. Only

<sup>1</sup> Medical Record, July 25, 1914, p. 158.

<sup>2</sup> Journal of the American Medical Association, December 27, 1913, p. 2293.

one strain was used. The nose and throat were copiously sprayed three or more times a day, and no other form of treatment was used locally. There were no untoward results. Of 22 cases of diphtheria, 5 cases, or 22.8 per cent., showed 2 negative cultures before thirty days, while of 22 cases not sprayed, 4 cases, or 18.2 per cent. cleared up also before thirty days. In 20 cases of healthy carriers treated with the spray, 7 cases, or 35 per cent., showed 2 negative cultures before thirty-five days, while of 20 cases not sprayed, 4 cases, or 20 per cent., cleared up before sixty days. His results are not at all encouraging and do not coincide at all with the favorable reports previously commented on. It is interesting to note in this instance that the carriers apparently did not spread the disease after sixty days. If we could have reports on a series of similar observations it would be of the greatest possible value to health officers and others having to deal with the practical work of quarantining diphtheria cases.

**Amebic Dysentery.** AMEBIC DYSENTERY IN CHILDREN. Some years ago, Amberg called attention to this subject, which he regarded as of considerable importance, and to a point which is very interesting, viz., that the disease may be encountered where it would ordinarily not be expected.

Recently, DeBuys,<sup>1</sup> has reported his experience in children, and he believes that while the disease is really less frequent in children than in adults, it probably often exists without being diagnosed. Some idea of the frequency of the disease may be obtained from the records of the Charity Hospital in New Orleans, where, for the past eight and a half years, there have been on an average 20,543 new cases annually, and where a total of 94,161 cases have been admitted to the hospital. Of these, only 313 were cases of amebic dysentery, and only 4 of this number occurred in children under twelve years of age. At the Touro Infirmary, there were only 4 cases of amebic dysentery in over 3000 children. It should be noted that 2 of these were included in the above records. In all, 8 cases were seen, and 4 of these were treated with emetine in large doses, consisting of 1 grain given hypodermatically. The author refers to the effect as "spectacular," there being an immediate cessation of blood from the stools, and of the other symptoms. In none of the cases did the drug cause any untoward effect, in spite of the large doses used.

**THE CONTINUOUS PROPAGATION OF AMEBIC DYSENTERY IN ANIMALS.** This disease has been produced among several species of animals, but even under the most favorable conditions the percentage of successful infections varies between 25 and 50 per cent. Werner, in 1908, succeeded in carrying a strain of entameba through six passages, but, as a result of his experiments, he concluded that after a few passages in

<sup>1</sup> Journal of the American Medical Association, November 21, 1914.

animals the organism becomes avirulent, so that it will not produce symptoms, and in most cases will not even grow in the host. Hartmann found that the organism tended to die out after the second or third transfer.

This subject has also been studied by Wenyon, who believes that it is possible to carry a strain of *entameba* indefinitely in animals, and by Darling who tried to demonstrate that this parasite becomes avirulent through changes undergone during the morphologic and life cycle.

Baetjer and Sellards<sup>1</sup> have made a study of two strains of *entameba histolytica*. The first strain was lost in the second passage, through an accident, but the second was carried through eleven passages in kittens. During this time there was increase in the virulence, and no degeneration whatever appeared in the parasites taken from the site of active lesions. The clinical characteristics were retained throughout the various transfers, as well as the pathological lesions. The propagation of the organisms seemed to be dependent considerably upon the virulence of the accompanying bacteria, and they believe that the changes in the morphology of the organisms may be explained by the fact that a long period of time elapsed during which the specimens may have remained in the bowel before they were examined, or else, the taking of specimens from a comparatively late period in the infection.

The same authors<sup>2</sup> have been able to reproduce the disease in kittens, either by inoculation by rectum, or by feeding the ameba by mouth. About 50 per cent. of such trials are successful. They found, however, that, by inoculation directly into the cecum, infection could be produced in every instance. They found that while the ameba is able to injure and penetrate the healthy mucosa, unrestricted growth of the bacteria in the intestine seems to be unfavorable to the ameba; that with the suppression of the bacterial growth the parasite develops more readily.

**THE USE OF EMETINE IN AMEBIC DYSENTERY.** The hypodermic use of this drug in dysentery was suggested by Rogers, in 1912, but it is interesting to note that ipecac, from which it is derived, had been suggested for dysentery many years ago. The drug was introduced into Europe about 1649 by Piso, and, in 1689, Helvetius cured the Dauphin of dysentery, and for this was well paid in fame and money, and he eventually sold the secret of his success to the French Government. Since then, the drug has been extensively used. The alkaloid emetine was separated by Pelletier in 1817, but what he obtained was probably a mixture of several alkaloids. Interest in the drug was revived a few years ago, and Walsh, in 1891, suggested the use of emetine in the treatment of dysentery in combination with mercuric iodide. This combination is not affected by acid, and is supposed to pass through

<sup>1</sup> Bulletin of the Johns Hopkins Hospital, June, 1914, p. 167.

<sup>2</sup> Ibid., November, 1914.

the stomach unchanged. His report consisted of 34 cases treated with good results.

Vedder, in 1911, points out that emetine and ipecac are useful only in cases of amebic dysentery, and are of little or no use in those of bacillary origin. He showed, by experiments, that the drug was a powerful amebicide, killing the organisms even in dilution of one to one hundred thousand. To Rogers, however, belongs the credit of having suggested the hypodermatic use of this drug, and his first report, in 1912, received widespread attention.

Since that time, the drug has been used all over the world and a number of reports have been made, all of which tend to show that this new method of treatment has been taken up enthusiastically and seems to demonstrate that emetine is more or less of a specific cure of amebic infections. The drug has not been attended by any untoward symptoms if used in moderate doses, and, as a rule, caused rapid subsidence of the liver and intestinal symptoms, together with the disappearance of active amebæ. The drug has little or no effect upon cysts. Allan,<sup>1</sup> has contributed another article, dealing with his own and other observers' experiences. Allan's article contains a review of twenty-three articles and is largely concerned with the permanence of cure after this method of treatment. The dosage used by most observers is that introduced by Rogers which consists of  $\frac{1}{3}$  to 1 grain, twice a day, given either daily or every other day for a week or ten days. Rogers had 32 cases in which the active amebæ disappeared promptly, and one case was reported as well five months later. There is no definite information regarding the fate of the other cases, but Rogers is inclined to believe that they were permanently cured. Numerous other observers report cures, but the subsequent history is not given. Thus, Chauffard reports 3 cases; Maxwell, 10 cases; Rouget and Flandin, and others, one or more cases in which the statement is made that the patient had been cured, but one does not know for how long. Lyons,<sup>2</sup> has reported 7 cases; one was moribund when first seen and the other 6 were cured, and five months after the treatment there had been no return. A number of other observers also failed to state the subsequent history of the cases, but Allan gives us the details of 12 cases, 6 of these cases had relapse, the earliest relapse occurred ten days after the treatment, the longest three and a half months, 1 of these cases had no relapse subsequently for twelve months, and 8 of the cases were entirely well at the time of the report. The length of time of treatment varies from two to twelve months. Baermann and Heinemann have reported 22 cases treated in Sumatra; in 7, the treatment was administered so late in the disease, no effect was expected or obtained. In 3 of these sections, they were free from amebæ, in 3 they were still seen in the section, and in

<sup>1</sup> American Journal of Tropical Diseases and Preventive Medicine, February, 1914.

<sup>2</sup> New Orleans Medical and Surgical Journal, October, 1913, p. 278.

1 case, in which a single dose was given, many were found. Their report is made six months after the treatment and, out of the 15 cases, 3 were still free from amebæ and cysts. They do not believe that single subcutaneous injections are advisable. They have obtained their best results through intravenous injections, using from 70 to 400 milligrams. They believe in some cases that there are strains of amebæ which resist emetine.

Friedenwald and Rosenthal<sup>1</sup> have reported 9 cases, all treated successfully, and in every case except one, they demonstrated the presence of amebæ in the rectal ulcers. In the case in which they were not found, the patients had been using argyrol injections constantly, but there could be no doubt about the diagnosis even in this case. Some of their patients were treated in 1912, and some of them relapsed, so that they suggested that after an apparent cure, *it is a good plan to give the drug intermittently until one can be certain that there will be no return.*

Holt<sup>2</sup> states that reports from seventeen officers of the United States Public Health Service have shown that it has been used with what may be called uniform success. Unfortunately, the cases which have been reported with care have not been followed up. Many of the clinical reports made, only take into account the first two or three months after the treatment, and some a much shorter time. Holt refers to cases from which he was able to transmit the amebæ after the treatment, but they were markedly diminished in number, and for the most part non-mobile. Whether or not these cases may be regarded as dangerous amebæ carriers is a question which will have to wait further study.

The question of relapse has been considered by Dopter.<sup>3</sup> He states that the drug does not prevent relapses, and, out of 46 cases, he has had 10 relapses; 2 cases in thirty days, 3 after three months, and 5 after six months. But in all of these cases, the relapse yielded readily to a second dose.

Vedder,<sup>4</sup> in a more recent report, believes that it is impossible to state at the present time that patients treated by emetine will remain permanently cured, yet he believes that the prospects for permanent cure by this method are good.

**Erythema Infectiosum.** This disease has been known a number of years but very little has been written about it. The first observations were made by Tschämer, in Graz in 1886, and subsequently by Gump-lowicz, in 1891, and Tobeitz, in 1896, described the disease, but up to this time it was not definitely separated from German measles. Escherich, and also his pupil, Schmidt, in 1899, were convinced of the identity of the disease. In the same year it was described by von Sticker and

<sup>1</sup> New York Medical Journal, July 4, 1914, p. 3.

<sup>2</sup> Public Health Reports, July 21, 1914, vol. 29.

<sup>3</sup> Bulletin de L'Ecole de Medecine, Paris, 1913, vol. lxx, p. 442.

<sup>4</sup> Journal of the American Medical Association, February 14, 1914.

his pupil, Beberich. The name erythema was given to it by the latter. Since that time, small epidemics have been described by von Plachte and Feilchenfeld, in Berlin; Tripke, in Koblenz; Pospischill and Eschereich, in Vienna; by Heimann, in Solingen; and by Trumpp, Sepp and Pfaundler in Munich. Taken all together, these observers have recorded about 300 cases. This disease has also been described by other observers under the names including various forms of erythema, such as erythema variabile, erythema simplex marginatum and erythema infantum febrile, the fifth disease, and so on. Tobler,<sup>1</sup> describes a small epidemic occurring in Breslau. The first child was seen in the outpatient department and there was considerable discussion concerning the diagnosis. The dermatologists inclined to the view that it was a toxic erythema. Two weeks later, however, a second child was seen with the same eruption and soon after the number of cases increased, 35 of which came under the personal observation of the author. This epidemic in Breslau occurred in mid-winter and most of the epidemics heretofore described have occurred in summer, a fact which helps some in the diagnosis, inasmuch as measles and German measles are commonly seen in cold weather. The susceptibility of individuals to the disease is rather great, but not general. In nursing infants the disease is practically unknown, and up to the second year of life but few cases are seen. From this time up to the school age the number of cases increases. The majority of cases seen by Tobler occurred during the sixth and twelfth year of life, although the disease may occur in adults. Pfaundler describes a case that occurred in his assistant, and Tobler tells that two of his assistants and a laboratory worker had been infected with the disease. It has a slight tendency to be more common in females. There are generally two or more cases in a family where there are susceptible children. The incubation period has not been definitely determined but it is between five and fourteen days. It is also probable, as in some of the other infectious diseases, that it is more liable to be transmitted early than after the eruption is out. Tobler relates one incident of a four year old child with a developed eruption and who was associated with other children, none of which developed the disease.

There are no prodromes and the symptoms, as a result, are not marked. There is burning of the face and more or less itching, but there are many variations in the sensations. In many cases there is no fever, while in some there is a slight rise in temperature. There is slight redness of the conjunctiva, especially on the edge of the lower lid and occasionally there is slight redness of some of the other mucous membranes. Occasionally there is slight swelling of the lymph nodes. The spleen is not enlarged, and there is no disturbance of the internal organs. The diagnosis of the disease lies chiefly in the appearance of the exanthem.

<sup>1</sup> Berliner klinische Wochenschrift, March, 1914, No. 12, p. 544.

On the first day the rash appears on the face and is described as a rose-red efflorescence which covers the cheeks, extending to the nasolabial folds in front, to the temples above, and laterally as far as the angles of the jaw. Over this area the rash is confluent, slightly raised above the surface, and, for the most part, sharply outlined, although in places it may fade gradually into the healthy skin. The general appearance is that of erysipelas, but while the skin is hot to the touch, it is not sensitive, and does not itch. There is no subcutaneous hemorrhage on pinching the skin. The rash disappears on pressure, but reappears quickly when the pressure is removed. On the following day the eruption extends to other parts of the body, and there are discrete patches on the forehead and chin. It spreads slowly downward on the trunk, where it appears as discrete, somewhat crescentic patches, from an eighth to half an inch long, suggesting measles, although it may also be wheal-like, resembling urticaria. The eruption is marked on the extensor and outer surfaces of the arms and legs, and about the elbows and buttocks; it may be confluent. Over the extremities the rash is morbilliform, and the spots run together, forming map-like areas which are specially marked when the eruption begins to fade. Shaw suggests that it resembles lace work. The color varies from a rose-red to a brownish red. The hands and feet are the last places to be affected, and the mucous membranes are not involved. The eruption fades first from the face after four or five days, and later disappears from the body. It lasts from six to ten days, and in some cases may disappear, and then reappear after a short time. There is no subsequent pigmentation or desquamation.

**Filarial Infection Simulating Plague.** A remarkable case of filarial infection was reported by Martinez.<sup>1</sup> The patient, aged ten years, was admitted to the Quarantine Hospital as a suspected case of plague. The child was seriously ill, with fever and profound toxemia. In the region of the right groin, there were two small glandular infarcts. The attack had come on suddenly with a chill, high temperature, and vomiting. This was followed by delirium, stupor, and profuse diarrhea. The appearance of the patient suggested filariasis and the examination of the urine proved this to be correct. This was also confirmed by an examination of the blood and at autopsy.

The points of particular interest in this case are the fact that the patient died within a period of thirty-six hours from the clinical beginning of the disease, and the fact that the case might either have been regarded as one of malaria or plague. The examination of the urine and blood made the diagnosis clear.

In 9 per cent. of the cases, positive reactions were obtained with antigen of staphylococcus, streptococcus, and diphtheroid bacilli.

<sup>1</sup> Journal of the American Medical Association, May 23, 1914, p. 1622.

This is about what would be expected, or even a lower percentage than most of us would have predicted. In addition, about 5 per cent. of the positive reactions were obtained with *micrococcus catarrhalis*.

This whole subject is worthy of a more extended study, and it is quite possible that with further work the improvement in methods will give more valuable results.

**Complement Fixation in Gonococcus Infections.** An interesting study has been made of this subject by Kolmer and Brown.<sup>1</sup> They found that about 60 per cent. of all cases of gonorrhea gave a positive reaction to this test. The highest percentage of reactions was found in cases of arthritis which were believed, from clinical observation, to be of a gonorrheal nature. In a smaller series of cases of pyosalpinx there were 66 per cent. of positive reactions. This proves that this test is of especial value in determining the nature of various obscure cases of arthritis, and in inflammatory pelvic conditions in women. They also believe that it is of value in determining whether or not a given case of urethral infection is cured, or still harbors foci of living gonococci. They also found it useful in the diagnosis and treatment of vaginitis in children.

The reaction in gonorrhea can not be said, however, to be as satisfactory as it is in some diseases, inasmuch as the antibody is much smaller, unless there is a grave infection. Fixation of the complement by a bacterial amboceptor and antigen is not as marked as in the case of the reactions made to determine the presence of syphilis. They found that, to be of any value, the antigen must be polyvalent, those composed of a simple suspension of organisms not being satisfactory, and the alcoholic process of little or no value.

**Hookworm and Hemoglobinuria.** In spite of numerous studies on the etiology of hemoglobinuria and hemoglobinemia, these conditions remain still in the group of those whose pathology cannot be regarded as definitely settled. It is well known that these conditions may be brought about in a number of different ways; by exposure to excessive heat or cold, from the destruction of large surfaces of skin, and from the ingestion of various poisonous substances, such as potassium chlorate, phenacetin, pyrogallie acid, and also the stronger acids, as well as certain toxins and lysins, such as snake venom, tetanolysin, and staphylolysin. In addition to this, in certain infections, as in malaria, scarlet fever, and occasionally in others, this phenomenon is noted. It is ordinarily considered as an exaltation of the usual destruction of the red-blood cells, such as occurs in many anemic states. One naturally connects it with the organs supposed to deal with the destruction of blood cells, that is, the liver, the spleen, and the lymphatic nodes.

There are numerous changes in the blood in cases of hookworm

<sup>1</sup> Journal of Infectious Diseases, July, 1914, p. 6.

infection, and Manzi<sup>1</sup> has called attention to a case which is instructive in that this condition of hemoglobinuria should always lead to a careful examination for the various animal parasites. In Manzi's case, which was that of a girl, aged fourteen years, there was a marked anemia and a hemoglobin estimate of 45 per cent. The red-blood cells numbered 1,800,000, the white-blood cells 13,500. There was an increase in the polynuclear cells; the differential count showed the eosinophiles to be 10 per cent. It was not until all the other causes of the anemia had been considered, and all the other examinations made that finally an examination of the stools revealed large numbers of eggs of anchylostoma. Manzi devotes most of his article to a discussion of how the condition is brought about, but it would seem that the chief lesson he teaches is the importance of paying constant attention to a cause of hemoglobinuria, which may easily be overlooked.

**Oil of Chenopodium in Hookworm Disease.** A very large part of the thymol used in the treatment of hookworm disease is derived from European sources, chiefly from Germany, and the failure to secure an adequate supply owing to the European war must lead to the study of the drugs available as substitutes. Motter<sup>2</sup> has called attention to the use of chenopodium for this purpose.

It has been stated that this plant was used as a vermifuge by the Indians prior to the advent of Columbus. The oil now is derived from the plant which grows in waste places all over the United States. It is cultivated particularly in Maryland, and the oil that is derived from the cultivated plant is sometimes known as "Baltimore Oil." Chenopodium has been long known as a vermifuge, but for some reason it has gradually fallen into discredit. In 1906, Bruning published a study of the pharmacological actions of the oil, and since then there have been a number of contributions not only on the action, but upon the chemistry, of the oil. In 1912, a paper was presented to the Fifteenth International Congress on Hygiene and Demography by Schüffner and Vervoort. They claim that the oil of chenopodium is superior to the other vermifuges. Their experience during a period of eight months in 1475 cases treated, shows the comparative efficiency expressed in coefficients to be: Chenopodium, 91; thymol, 83; naphthol, 68; and oil of eucalyptus, 38. The literature concerning the toxicological properties of this oil shows 12 published cases in something over fifty years, the first having been published in 1852, and the last in 1903. Of these cases, 8 were fatal, but Wood does not believe that the seed was the immediate cause of the fatal result in all of these cases. They all show, however, that the toxic action was chiefly upon the central nervous system. Salant has demonstrated that the toxic action may

<sup>1</sup> Il Policlinico, Sezione Practica, July 12, 1914.

<sup>2</sup> Public Health Reports, October 2, 1914, p. 2651.

be due to the cumulative action, as nontoxic doses repeated in a day or two produced fatal results in the rabbit.

The drug apparently does not kill the parasite, but seems to paralyze it, during which period it must be gotten rid of by free purgation. It is interesting to note that it may be administered in castor oil, and, unlike aspidium and thymol, that oil does not add to the toxicity of the chenopodium, but affords an easy method of getting rid of the parasite and of the drug.

Schüffner and Vervoort give the drug in sixteen-drop doses, in sugar, every three hours, for three doses. Two hours afterward they give a tablespoonful of castor oil with a teaspoonful of chloroform. Gockel gives the single dose as from 8 to 16 drops for the adult, and for other ages, six to eight years, 8 drops; nine to ten years, 10 drops; eleven to sixteen years, 12 drops; and after that period adult doses.

The symptoms in cases in which too much of the oil has been used are depression, and drowsiness. If these symptoms supervene, the drug should be withdrawn at once and free purgation induced. Stimulation with strong hot coffee or caffeine should be used.

Owing to the comparatively little data at hand concerning the efficiency of chenopodium in hookworm disease, it would be well for all physicians using this remedy to report results in the medical journals, giving, if possible, the source of the oil used, as it has been supposed that chenopodium growing in various localities differs in its efficiency.

If the oil cannot be obtained, the plant may be tried as a decoction, by boiling one ounce of the fresh plant in a pint of milk or water, and administering it in wineglass doses.

Levy<sup>1</sup> has also made a study of this subject, and has used it with perfectly satisfactory results. He also gives a table of 12 reported cases of poisoning with oil of chenopodium, which are of considerable interest in this connection. Eight of these 12 cases occurred in children under thirteen years of age, and 9 of the 12 ended fatally. In 7 instances the individuals received what may be considered an overdose; of the remaining 5, the dosage is unknown in 2, and in 1, an oil was given which was supposed to be the wormseed oil but which had been obtained from a wandering quack. The symptoms of poisoning made their appearance usually several hours after taking the oil, and consisted of persistent nausea, vomiting, abdominal pain, and headache. Within a short time there is deafness and tinnitus aurium, and drowsiness. In some instances there was ataxia, and, in the fatal cases, coma, with a very rapid pulse and convulsions. Only one of the cases came to autopsy, and the report throws very little light upon the process of the poisoning.

**Epidemic Catarrhal Jaundice.** This disease has attracted attention from time to time, and has been known under various names, such as

<sup>1</sup> Journal of the American Medical Association, November 28, 1914.

*Weil's disease*, and *bilious fever*. One of the best of the recent articles on the subject is by Knoffelmacher.<sup>1</sup> The first study of any importance was that of Weil made in 1886, who described an epidemic and laid particular stress upon the acute onset, the marked jaundice which develops very quickly, the tender liver and spleen, the frequent albuminuria and often severe nephritis. The disease lasts from a few days to a few weeks, and there is an especial tendency to relapse.

There is the greatest difference of opinion as to whether the disease should be considered as a separate clinical entity, or as a form of benign infectious jaundice which may be due to a number of different organisms under certain conditions. The work of Rosenow would suggest the latter, as a streptococcus has been observed at times to take on the characteristics which lead it to attack the gall-bladder and bile passages and this may be true of other organisms.

Various organisms have been described in connection with this disease, and, in Germany, Jaeger described a bacillus of the proteus group; other observers have found the colon bacillus, and other organisms which are closely allied have been noted. Cockayne<sup>2</sup> has contributed two articles on the subject, the first of which tries to prove that catarrhal jaundice should be classed with measles and mumps, as one of the specific infectious diseases, due to an unknown organism, and he regards it as an infective hepatitis.

In England, something less than forty epidemics have found their way into the medical literature, but smaller groups of cases are rarely reported, and Cockayne believes that the disease is rather more common than is ordinarily supposed. In one epidemic, he was able to state with considerable authority that the disease is not spread either by water or by milk, and the inference was that the disease is conveyed from child to child in the schoolroom. In one epidemic all the children were attacked within a period of twelve days, and it would seem that the incubation period was short, possibly between one and three days. In the other epidemic the incubation period was evidently longer, there being an interval of ten days between the cases of a brother and a sister, and occasionally longer intervals of time have apparently elapsed before the disease developed. Gibson gives the incubation period as from three to fourteen days, but also mentions two instances, one in which he believed the interval to be twenty-seven days, and another when he believed it to be forty-seven days. From Cockayne's observations, it would seem that the disease is most infectious in the prodromal period.

The disease is sometimes mistaken for relapsing fever, in which case the spirillum of Obermeier will serve to differentiate it. Occasionally, it is taken for dengue or yellow fever, but both of these diseases occur

<sup>1</sup> *Ergebnisse der Inner Medizin*, 1910, p. 205.

<sup>2</sup> *Quarterly Journal of Medicine*, 1912.

in certain rather well defined zones, and not in the absence of the *Stegomyia* mosquito.

Strauch<sup>1</sup> has also made a report on this disease. He saw a small epidemic affecting four children in one family, the cases running consecutively. The first child was taken sick on November 10, the second on November 30, the third on December 1, and the fourth on December 4, and there was no evidence of any indigestion due to errors of diet, nor was there any acute food poisoning.

While most of the records of this disease have been obtained from foreign cities, there have been a number of epidemics in this country, the chief of which occurred during the Civil War. Dixon,<sup>2</sup> reports an epidemic of 200 or more cases, 25 of which were children, and 8 infants. Collins, in 1910, observed an epidemic in Austin, Minnesota, in which there were about 200 cases, the youngest patient being ten years old. Leslie<sup>3</sup> described an epidemic occurring at Andover, Maine, in which there were over 135 cases within six months. There are numerous other examples, many of which have been mentioned and reported, among these is a report by Barker and Sladen, of an epidemic of 6 cases occurring in the Baltimore City jail.

**Kala-azar.** INFANTILE KALA-AZAR. There have been a large number of contributions made on this subject, most of which have appeared in foreign journals, and particularly in the little circulated periodicals of Spain. Martinez<sup>4</sup> has made a study of the disease as it occurs in Spain based on his own observations and the published reports. It is generally believed that the disease is contracted from dogs who suffer with the disease, as was shown by Nicolle. In Tunis, the autopsies of 222 dogs showed lesions caused by the parasite. Sargent and Senevet found 8 per cent. of the animals infected in summer and 1.6 per cent. during the months from April to June. Various observers studied the disease as it occurs in the dog, including Basile, Jackinoff and Kohl.

The canine leishmaniosis has been noted in two forms; in the acute disease, and the experimental form. The acute disease is seen in young dogs and is characterized by anorexia and diarrhea, a high, inconstant and variable fever, anemia, alopecia, paralysis of the legs, and death. There is also a chronic form which is manifested by emaciation and loss of appetite, torpor, and weakness.

All of the cases observed by Martinez, with one exception, were in the children of poor workmen inhabiting houses frequented by dogs. In 25 cases, 7 occurred in girls, and 18 in boys, or 28 per cent. in girls and 72 per cent. in boys. The disease was seen between the ninth and

<sup>1</sup> Medical Record, April 18, 1914, p. 710.

<sup>2</sup> Alabama Medical Journal, 1907.

<sup>3</sup> Boston Medical and Surgical Journal, October 28, 1909.

<sup>4</sup> Revista Ibero Americana de Ciencias Médicas, November, 1913, p. 308.

forty-eighth month, with an average of twenty-two months. The disease generally was commenced in the months of April, May, June and July, and the fewest cases were noted in December, January, and February. This is probably due to the difference in temperature, the differences in the presence of insects, and the fact that in the winter the families live in the town while in the summer they migrate into the fields. In some instances the children were weak and below par when they were infected, but most of the children were comparatively healthy up to the time of the infection with the parasite.

The disease generally began with an intermittent fever; this was followed by enlargement of the spleen and, in most of the cases, with diarrhea and other symptoms relating to the gastro-intestinal tract. In some cases there was pronounced vomiting. The disease did not follow any definite course; there were great variations in the symptoms but in a general way they may be described as having three stages as suggested by Di Cristina. In the first stage there are intestinal disturbances, with or without fever; blood changes are marked, and the spleen is palpated with difficulty. In the second stage there is fever, marked lowering in the hemoglobin and the number of red cells, changes in the leukocytes, pale skin and mucous membranes, purpura and petechia, marked enlargement of the spleen and pronounced disturbances of nutrition. In the third stage there is continuous fever, a most intense grade of anemia, enlargement of the spleen and sometimes infarct of it. In this stage the liver is involved, the skin becomes a waxy color, there is profound emaciation, marked cardio-vascular disturbances and frequently noma and enterocolitis.

In going over these various symptoms, Martinez called attention to the fact that most of the children showed a curious pallor which might be compared to the yellowness seen in old wax, but in some cases there was a marked grade of icterus. He did not see, at any time, the earthy tint described by the English physicians in India, nor the cadaverous appearance described by Jemma as occurring only in kala-azar. The purpura was frequently in a form of spots more or less extended and these were generally upon the abdomen, thorax or shoulders, sometimes punctiform and at other times not. Nicolle has described a maculo-vesicular lesion, and Jemma and others have described desquamation. The mucous membranes are pale and discolored, with a marked tendency to hemorrhage, and epistaxis is frequently observed. Edema of the feet, hands, face, and scrotum is frequently seen. This is wanting in some cases; in others, it only comes on a short time before death, but sometimes it begins early, may be more or less generalized and hard, and sometimes, in these last described cases, it may disappear under the influence of a proper diet. Frequently it is limited to the malleolar regions and in these cases it is fugacious, disappearing and reappearing without treatment and without any apparent reason.

Martinez did not observe any cases in which there were casts but the urinary sediment was not examined in all. In all cases there was enlargement of the lymph nodes. They were hard, not very much enlarged in size and most easily observed in the inguinal, cervical, and axillary regions. Martinez did not see any cases in which they suppurated, although this has been described by Levi and Cortezi. In the cases in which there is suppuration of the lymph nodes, it may be regarded as the result of a secondary infection.

As regards the *digestive tract*, a large number of cases begin with gastrointestinal symptoms, most frequently diarrhea, but in many there is vomiting. The stools resemble those of typhoid fever, and hemorrhages are not infrequent. In addition to this, there is loss of appetite, or perversions of it, and nausea. In the advanced cases, various forms of stomatitis are frequently seen. In some, there were some maxillary infections which caused a very marked odor to the breath and interfered with the child's nursing. In these cases the mouth was held open, and there was a very abundant flow of saliva. The enlargement of the spleen was not influenced by exposure to the x-ray and the changes in the spleen did not seem to bear any relation to either the diarrheas, to the fever, or to the course of the disease. In all the cases there was tachycardia, and the heart was generally somewhat enlarged.

The *blood changes* were marked, hemoglobin generally varying between 40 and 75, with a parallel diminution in the number of red-blood cells, generally from 3 to 4 millimeters or much less. There was a distinct leukopenia varying between three thousand and normal. Occasionally the number of white cells was somewhat above normal. There was an absence and diminution of the eosinophiles and an increase in the lymphocytes and the large mononuclears. This increase in the mononuclears is compensated for by a corresponding decrease in the polynuclears. Various nervous symptoms were present in many of the cases, and convulsions suggesting meningitis were present just before death in a large number of the cases. The organs of special sense remained intact.

The *course* of the disease is progressive. Sometimes there are slight remissions, with disappearance of the fever and diminution in the size of the spleen, and this sometimes corresponded to various forms of medication but in all cases this amelioration was transient. The duration of the disease is variable. The first stage may last several months and the second even longer, while the terminal or third stage of the disease is short. Sometimes the disease runs a rapid course, proving fatal in the first few weeks, and on other occasions it has been noted to last for several years. In the cases observed by Martinez in which the time could be accurately fixed, it varied between four and seventeen months, with an average of about nine months.

Pater<sup>1</sup> has also considered the subject of infantile kala-azar. According to him, the only method of making a certain diagnosis is by puncturing the spleen, according to the method suggested by Nicolle. This is rendered a much more simple operation than it would ordinarily be, by the enlargement of the spleen, and if done under the usual aseptic precautions, with a small needle, a small amount of spleen pulp and blood may be withdrawn without difficulty. The material so obtained may be stained according to any of the well known methods, such as Giemsa's method or those suggested by Leishman, Romanowsky, or Laveran. The organisms are usually present in large numbers, either mononuclear cells, or isolated, or in groups, outside of the leukocytes. Stained by the Giemsa method, the protoplasm is a pale blue, the nucleus violet, and the centrosomes red. In cases in which the organism is not discovered in the fresh preparation, the *Leishmania* may be cultivated by using a drop of the blood and the culture medium suggested by Nicolle.

The treatment of the disease is exceedingly unsatisfactory. Most important is the prevention of infection. The protection of the child from coming in contact with infected animals, and the destruction of dogs already infected are the most important measures. Unfortunately, the diagnosis of the dog is not always an easy matter, although it may be made by trephining the bones or aspirating the liver. Sometimes the organisms are found in the circulating blood. After infection has taken place, various antiseptics have been tried, including quinine, arsenic in its various forms, including salvarsan, intravenous injections of bichloride of mercury, iodine, and iodid preparations, but for the most part these medicaments are without effect. The same is true of the exposure to the Röntgen rays. The ablation of the spleen has been attempted, and Matilios and Cristiny Cannata have performed this operation a number of times. All of their patients have lived, and they suppose that following the removal of the spleen there appear in the blood specific antibodies.

SEGREGATION IN ERADICATING KALA-AZAR. Price and Rogers<sup>2</sup> have made a study of the measures taken to eradicate kala-azar from the Assam Tea Gardens. These investigations had begun in 1906, previous to which time Price had for several years watched the insidious invasion of the coolie lines from the tea estates of the neighboring villages by the terrible epidemic of kala-azar which was then sweeping through the Nowgong district. This epidemic was of such severity that, during the decade from 1891 to 1901, it caused an actual decrease of no less than 31.5 per cent. in the population. The disease is plainly a communicable one, and Price and Rogers independently arrived at the conclusion that it was a house infection. They found that, in 1898, at

<sup>1</sup> *La Clinica Moderna*, September 15, 1914, p. 546.

<sup>2</sup> *British Medical Journal*, February 7, 1914, p. 285.

Pangamati, out of 150 coolies who had resided for two years in new quarters not one had developed the disease, while of 50 coolies of the same lot who, for want of room in the new quarters, were housed in the old ones, 16 per cent. were dead, while others were suffering with the disease, and this in spite of the fact that the new quarters were only 300 yards from the old ones. It was decided to carry out further experiments to ascertain if the disease could be stamped out in the already infected quarters by moving out the healthy persons and segregating the infected remaining families. This experiment was done and it was found that 144 out of 240 had cases of the disease in their household, so that only the remaining 96 people could be removed, and 5 of these had to be sent back very soon afterward on account of developing the fever. Eight hundred additional workers were reported and from then to the present time, that is for sixteen years, they have remained absolutely free from kala-azar. Of the people who had to be left in the old infected lines, nearly all contracted the disease and died of it in the next few years and the disease spread to the neighboring lines with 600 healthy coolies who had worked for years on the estate and who refused to be moved to new quarters. One-third of them died of the disease within the next fifteen months and the rest nearly all succumbed or left the estate during the succeeding fifteen years.

The remarkably successful results obtained in this first experiment encouraged other tea garden managers and directors to allow Price to continue the procedure in connection with other coolie lines infected by kala-azar, and Price and Rogers have recently studied the results so obtained in the last sixteen years. In ten different estates, with the total working population of 6727, in which there had occurred 1393 deaths or 207 per thousand, the result of moving into new quarters was that the coolies remained free from the disease; while of the infected left behind, a total of 689, 361 subsequently died of the disease. The new quarters were established at varying distances from the old, the shortest 300 yards, the longest  $\frac{3}{4}$  of a mile, and the total length of time in the various experiments ranges from eighteen months to two and a half years for all, with one exception over eight years.

The uniform success of these prophylactic measures is a matter of great importance and as the distances of the removal of the huts were only a few hundred yards the mode of infection by any flying insect, as the mosquito, can be set aside. In fact it was found that malaria fever was as common in the new quarters as it had been in the old. They were also able to exclude water and diet as a cause. The authors believe that the disease is produced by some biting insect and suggest that the bed-bug is the one at fault. Patton, after many months' study of the problem, succeeded occasionally in demonstrating the development of the flagellate stage of the parasite in bed-bugs fed on kala-azar patients who showed the parasite in their peripheral blood.

Efforts taken to free the house of the bed-bug by fumigation with sulphur and disinfecting the beds with a solution of corrosive sublimate in boiling water and burning old clothes were followed by the disappearance of the disease from a row of badly infected coolie huts, but the measure was found to be troublesome and expensive, and cases appeared in other parts of the lines and the disease was not completely stamped out. Burning the thatched roofs in the houses also failed to prevent subsequent cases occurring in them. The mud walls of these houses were over two feet in thickness and the flames died down long before the whole thickness of the walls could have been sufficiently heated to destroy all the bed-bugs within their crevices, so that the failure of this measure can easily be understood. Curiously enough, the authors did not mention the flea as a possible means of transmitting the disease. Certain observers believe that this insect is the one at fault, although Gabbi, after making numerous experiments, was unable to transmit the disease by means of fleas.

**Leprosy.** SEGREGATION OF LEPROSY. I have called attention several times to the necessity of starting a leper colony in the United States, where individuals suffering with this disease may be segregated and at the same time allowed to live out their lives under as satisfactory conditions as may be obtained for persons with restricted liberties. It should be recognized that the leper is not a criminal, and if society sees fit to isolate him, he should be furnished with care and comfort at the expense of the State.

Rucker<sup>1</sup> read a paper before the American Medical Association in June, 1914, in which he considered this subject. His suggestion was that an act be passed by the Senate and House of Representatives providing that the Surgeon-General of the United States Public Health Service shall at the request of any State or territorial board of health appoint a body for the purpose of making diagnoses in the cases of persons suspected of having leprosy. This body is to consist of three commissioned medical officers of the United States Public Health Service who should be skilled in medical and bacteriological diagnosis, and their report is to be taken as final. His bill also proposes to appropriate five hundred thousand dollars (\$500,000) for the purpose of erecting and maintaining a national hospital for lepers, and provision is made for the purchase of the land and the construction of the building. The bill further provides for the maintenance of those persons who have been found to be lepers, and makes a provision for their detention and care.

Dyer<sup>2</sup> at the same meeting recommended that the Lafferty bill which was introduced in 1913, and which provides for the same things as the bill suggested by Rucker, without the detail of the latter should be passed.

<sup>1</sup> Journal of the American Medical Association, July 25, 1914, p. 297.

<sup>2</sup> *Ibid.*, p. 298.

There have been two reports made by the Public Health Service on the occurrence of leprosy in the United States. The first, in 1902, found 278 cases, of which 175 were in Louisiana. The second report, made in 1913, contains 146 cases found in continental United States, it being of particular interest to note that 40 of these were new cases reported during the year 1911. (PROGRESSIVE MEDICINE, March, 1913.)

Since 1894, the Louisiana Leper Home has been used to care for a large number of cases and at the present time there are nearly one hundred inmates. There are a number of cases of leprosy in a number of States. Dyer reports that Texas has between twenty-five and thirty, and possibly twice that number, and the disease has been met with in Alabama. There are about 30 cases in California, and it is estimated that there are some one hundred cases in the State of New York, and unrecorded cases in many other States. A large number of cases come from foreign countries. At the Academy of Medicine in New York 17 cases were shown, of which only two or three were native born.

As a general rule, very little attention is paid to leprosy in most of the United States, but occasional outbreaks of hysteria occur, in which the various States seem to vie with each other to see who can inflict the greatest discomfort upon the poor individual whose case happens to come before them. The cost of maintaining separate institutions by the State is too great, and the only rational solution of the problem is that of the establishment of a national hospital.

In the island possessions, provisions have been made for the segregation and care of these individuals. There is a large colony in Molokai for persons coming from the Sandwich Islands, and there are several colonies in the Philippines.

There have been a number of attempts to secure national legislation on this subject. Rayner, of Maryland, in 1900, introduced a bill following the lines laid down by the Berlin Leper Conference. This bill never got out of committee. In April, 1913, Lafferty introduced the bill alluded to above, but there has been no particular effort made to have it passed.

By law, an emigrant found to have the disease within three years after landing, if it can be shown that the disease existed prior to the arrival in the United States, is immediately deported. The fact that there is a large number of foreign born lepers in this country shows that this law does nothing more than to send back those individuals who have marked lesions, and who are recognized as lepers at the time of their landing. Anyone familiar with the disease knows the very long period of incubation, or a period when the lesions are so slight as to escape any but a very painstaking and thorough examination.

Concerning the transmission of leprosy we really know very little. We do know, however, that in the middle ages, in Europe, very terrible epidemics prevailed for long periods of time. We also know that the

disease is transmitted from one individual to another, but we do not, at the present time, know the conditions favorable to its spread. It would seem, therefore, that the sensible thing to do would be to stamp out the disease while there are relatively few cases about. We know, from the experience in Scandinavia, what can be done in this way. Instead of condemning a large number of people to isolation, it would seem to me that it would be a much better plan to provide for the segregation of all lepers with open lesions; all others could be registered and made to report to some health authority at stated intervals. From time to time, members of their households could be examined, and, in event of the development of the disease in other individuals, or if the leper develops open lesions, he could then be sent to a colony.

In dealing with infections, we, in this country, are inclined to overdo in certain instances, and vastly underdo in certain others. The leprosy problem should be a relatively simple one, and offer no difficulties of legislation or administration. Unfortunately, it seems to do both.

**THE TREATMENT OF LEPROSY.** Heiser<sup>1</sup> has reported the results of using a mixture of *chaulmoogra oil*. The mixture is composed of 60 c.c. each of chaulmoogra oil, and camphorated oil, and 4 grams of resorcin. These three constituents are mixed together, and dissolved with the aid of heat on a hot water bath and then filtered.

In previous reports, during the past two years, 4 cases of leprosy have been noted as apparently cured, and have remained cured for a period of two years. The first 2 cases were treated with chaulmoogra oil mixture, and at irregular intervals, a vaccine prepared from the so-called leprosy cultures of Clegg. The other 2 cases received only hypodermatic injections of chaulmoogra oil mixtures.

The first case<sup>2</sup> was a female, aged eleven, with large leprous macules on the outer surface of both legs, and the diagnosis of the disease was confirmed by microscopic examination. On January 7, 1911, chaulmoogra oil was started by mouth, in 10 drop doses three times a day, together with  $\frac{1}{60}$  of a grain of strychnine. By February 15, the nausea became so great that the patient refused to take any more of the oil, and it was administered hypodermically in a mixture composed of chaulmoogra oil, resorcin and camphorated oil. This mixture was given in 1 c.c. doses at weekly intervals, and gradually increased until 12 c.c. were given. The dose was then gradually reduced until 1 c.c. was reached, and then gradually increased again to the maximum dose. On October 15, 1911, the patient was microscopically negative to leprosy. The patient refused any form of treatment from that time until January 7, 1913, during which the examination had been negative for leprosy. The ascending and descending doses of the chaulmoogra oil were administered as before. A few months after the

<sup>1</sup> Public Health Reports, October 16, 1914, p. 2763.

<sup>2</sup> Ibid., January 2, 1914, p. 21.

original hypodermatic injection of the oil was begun, the leprous macules began to ulcerate and these gradually healed, leaving behind no clinical evidence of the disease.

The second case was a Philippino, aged forty, admitted on May 4, 1911. He had a large pigmented macule on the leg, and another area above the ear. He was given the oil mixture at weekly intervals, and the dose was increased to 50 c.c. Larger doses than this caused palpitation of the heart and distress. By August 5, the leprosy bacilli could no longer be found, and he was placed under the observation and remained free for two years, and was subsequently discharged from the colony.

Twelve different types of leprosy were placed under treatment, and the results of these cases were summarized as follows:

#### STATISTICAL SUMMARY OF CASES.

Cases placed under treatment . . . . .	12
Cases taking treatment throughout period . . . . .	9
Cases apparently recovered, and microscopically negative . . . . .	1
Cases in which clinical evidence of leprosy practically disappeared . . . . .	4
Cases showing only slight evidences of improvement . . . . .	1
Cases declining to take prescribed treatment . . . . .	3

#### NET RESULTS.

	Per cent.
Apparent cures . . . . .	11.11
Apparent clinical recoveries . . . . .	44.44
Showing marked improvement . . . . .	33.33
Showing only slight evidence of improvement . . . . .	11.11

There has been a great amount of experimentation in leprosy. In the Philippine Islands, it has been customary to try any treatment which came to the attention of the Bureau of Health, if it could be done without harm to the patient. There have always been a large number of volunteers, so that there has been plenty of available material.

Two things that have given the best results have been the *x-rays*, and the administration of crude chaulmoogra oil by the mouth, but, in cases so treated, and apparently cured, the disease always returned within a year.

Chaulmoogra oil has been used in the treatment of leprosy for a long time, but it is very apt to produce nausea, and only a few patients are able to take it for long periods. All efforts to rid the oil of this objection have failed, as when the emetic principle has been removed, it apparently has no influence upon the disease. The oil has been used hypodermatically, but, as ordinarily administered, it is not absorbed. The Merck Company suggested that the oil might be combined with ether or camphor, and it was found that camphor gave the best results. Mercado suggested the combination of the oil with camphor and resorcin.

Various kinds of oil have been used, and, as far as the experiments

that have been made are concerned, there does not seem to be any difference between the crude and the refined oil. The injection is begun with a dose of 11 c.c., given at intervals of one week, and this is increased to the point of tolerance. The amount of the oil that a patient can take varies greatly, in some, fever and cardiac distress follow a few cubic centimeters. In some instances, smaller doses are given at frequent intervals. The observers believe that results were obtained more quickly when the mixture was injected into the large leprous deposits, and sometimes the dose was divided and injected into a number of small ones. In addition to the oil, saline purgatives were frequently used, but no strychnine was administered.

In addition to these measures, hot baths, containing 2 per cent. of sodium bicarbonate were used every other day, and they believe that those who took prolonged hot baths improved more rapidly than those who did not.

**Malaria.** QUININE PROPHYLAXIS FOR MALARIA. Of course the ideal method of getting rid of malaria is to get rid of the anopheles mosquito. It remains a fact, however, that there are many regions in which the destruction of the mosquito is not possible at the present time and in these regions many people must live constantly exposed to one of the greatest scourges of the human race. The use of quinine in these districts has been employed in various places to solve the problem and what has been done has been reviewed by Carter.<sup>1</sup> For this purpose it was adopted as early as 1847, although it is quite probable that it had been used earlier than this. For the last ten years, in Italy, quinine has been used very extensively by the Italian government with very remarkable and satisfactory results. In 1902, the government began to sell quinine to the communes and towns at cost price, and it was given away to those unable to purchase it. The following year it was made obligatory to furnish it to poor people for prophylactic use, and in 1904 it was ordered to be given to all working people for use in this way.

In the ten years preceding the use of quinine, there were 14,048 deaths annually from malaria. For the first nine years of its use the average number of deaths was 5435, but during the last five years the number is only 3853 per year, or not much over one-fourth of the former number. Much more remarkable results have been obtained in the Italian army where its use has been compulsory in the malarial districts. Similar results have been obtained in Greece and Algeria, and in numerous other places in various parts of the world. Taking quinine in small doses over long periods of time does not seem to be injurious, and Carter states that the incidence of black water fever has been diminished in those taking the drug. There are some individuals in whom quinine

<sup>1</sup> Public Health Reports, March 27, 1914.

causes considerable discomfort, but, as a rule, one becomes accustomed to the drug and the disagreeable consequences generally disappear entirely later on.

Carter advises that, in malaria districts, it should be taken in from 7 to 8 grains per day by adults and 2 to 3 grains by children, unless the child is very small, and that this dose should be kept up during the malarial season, that is, from June to November. When the drug is very badly borne, the insoluble salts cause less discomfort, so that the tannate may be substituted, if necessary; for the administration to children the tannate is rather to be preferred because it may be put up in tablets with chocolate and sugar and is readily taken, and does not upset the stomach. Carter calls especial attention to the fact that many of the tablets and pills are insoluble, and he advises that if a tablet that has been dropped in a glass of water does not begin to crumble within from five to ten minutes it is not suitable for use.

MOSQUITOES IN MALARIA. One would hesitate to call attention to anything in connection with mosquitoes and malaria, were it not for the fact that for some reason or other the lesson that should be so easily learned has fallen on deaf ears as far as most of the United States are concerned. The United States may go to Havana and eradicate tropical disease; it can take the Isthmus of Panama, confessedly one of the worst spots in the world for infections, and in a few years time healthy conditions are established, the equal, if not the superior, of any in the temperate zones. In the United States the national and local governments, chiefly from their political associations, but partly from the indifference of the citizens, have been unable to cope with the problem of the destruction of the mosquito, and hence ridding the community of malaria and the possibility of yellow fever, to say nothing of the comfort brought about by freedom from these pests.

Stiles<sup>1</sup> has recently published an article, which followed a visit to some of the towns in Eastern North Carolina. The problem of ridding a community of mosquitoes resolves itself into two points: What must be done in the town, and what must be done in the surroundings? In the first place, buildings must be screened, and this should include every dwelling and every privy. The breeding places of mosquitoes are numerous. Systematic collection and destruction of tin cans, tin buckets, bottles, kegs, barrels, and boxes, and all other receptacles for water must be undertaken, and this must be repeated from time to time. At Moorehead City, the public school children organized into a band for the destruction of tin cans, and in two weeks time, they had collected more than 32,256 cans. Owing to the danger of cuts from broken glass, bottles and similar objects should be collected by the municipality. Fire buckets and fire barrels should be screened or

<sup>1</sup> Public Health Service Reports, September 24, 1914, vol. xxix, p. 36.

treated with a small quantity of kerosene, or the water in them should be very frequently changed. Open surface wells, which are not in use, should be covered, and all standing water should be drained away, as far as possible, and, where this is not feasible, kerosene should be used to render it innocuous. Nothing can be accomplished in a town unless an active campaign is waged. The average American has little interest in the prevention of disease unless aroused to a condition of hysteria by an epidemic, but the education of the present generation of children in health matters may do much to correct this in future. The municipality should be urged to look after the draining off of water standing in gutters, and their attention should be called to the presence of boats partly filled with water.

Outside of the towns the draining of marsh lands, and bodies of standing water is most important. Dyer has called attention to the fact that until the conditions that lead to the propagation of the mosquito in the town are done away with, the importance of the effect upon the surroundings can not be estimated. As soon as the intraurban breeding places are eliminated, the part played by the surrounding country as a source of them can be easily and quickly ascertained.

Except in the cases of small marshes or small bodies of water, the problem of elimination is one of economics and engineering. Stiles is of the opinion that until the communities throughout the country prevent the breeding of mosquitoes within their borders the eradication of the mosquito in the outlying districts need hardly be considered by the health authorities.

**MIGRATION OF THE MALARIA PARASITES.** Several studies have been made upon this subject by Mary Rowley-Lawson.<sup>1</sup> Her conception of the malaria parasite is that it is extracellular throughout its entire existence, that is to say that it is attached to the external surface of the red corpuscles and is not within it. From time to time the parasite changes from one corpuscle to another. She believes that the parasite attaches itself to the corpuscle by means of pseudopodi, put out from the cytoplasm of the parasite. She also believes that each parasite, in the course of its development, destroys several red corpuscles, and that this explains the rapid anemia which occurs in the course of malarial infection.

She believes that the evidence in favor of migration is that the destruction of the red cells is out of all proportion to the number of parasites present, provided that each parasite destroys but one cell, also that in multiple infection of the corpuscle by several young parasites, if these do not die, they must migrate. She believes that she has observed stages in parasitic migration.

In another article<sup>2</sup> she advances the view that the compact form of

<sup>1</sup> *Journal of Experimental Medicine*, 1914, vol. xix, p. 450.

<sup>2</sup> *Ibid.*, p. 523.

tertian parasite is the type of free parasite most often observed. This form is seen not only in migration, but after the administration of quinine, and also in the cadaver. She believes that this form is the normal resting form of the parasite, the other forms being assumed in order to secure attachment and to obtain food.

In studying the malaria parasite, care should be taken not to confound the protoplasmic pseudopodia of free parasites ready for attachment with sexual flagellating parasites, whose flagella are composed of chromatin.

Both of her articles are accompanied with plates of remarkable blood pictures, which will well repay study by anyone interested in this subject.

**Malta Fever.** MALTA FEVER IN LOUISIANA. This disease is gradually becoming of more and more importance in America. As early as 1905, Craig reported a case of Malta fever in Washington, D. C. In this case, the infection was supposed to have come from nursing soldiers infected in the Philippine Islands. At this time, he also reported 9 cases among such soldiers, and he suggested the study of all obscure and prolonged fevers with reference to the possibility of their being Malta fever. Since that time the interesting studies of Ferenbough and Gentry have appeared. They found the disease in Texas, in the Pecos river country, and all their patients had worked on goat ranches and drank the milk. I reviewed their report, together with several others in *PROGRESSIVE MEDICINE* for 1912. More recently, Young and Looney<sup>1</sup> have reported the disease in Arizona, and Wellman, Eustis and Schochet<sup>2</sup> have reported a case in a farmer aged fifty-three years, who had resided for fifteen years in Jackson county, Texas. The nature of his disease was discovered by doing routine agglutination tests with a culture of *Microbacillus melitensis*. This should be done in all cases of unexplained continued fever.

In this instance the patient had never kept goats, nor had he ever come in contact with them knowingly, nor partaken of goat's milk. He had not been in contact with anyone with fever or rheumatism for at least two years prior to his illness.

The disease began with vague pains about the body, irregular fever with occasional chills and sweats. He was treated for malaria and took large doses of quinine without effect. The diagnosis of the disease was made after his admission to the Presbyterian Hospital in New Orleans. He eventually died from bronchopneumonia. During the course of the disease he developed an acute arthritis of the left elbow-joint. This is of particular interest, as in sporadic cases of Malta fever the joint symptoms frequently lead to the incorrect diagnosis of rheumatism.

<sup>1</sup> Arizona Medical Journal, April, 1913, p. 13.

<sup>2</sup> American Journal of Tropical Diseases and Preventive Medicine, November, 1913, p. 393.

**THE AGGLUTINATION OF MICROBACILLUS MELITENSIS BY NORMAL COW'S MILK.** The agglutination of the organism causing Malta fever has been suggested as a means of diagnosis of the disease in the animal, and in Algiers and Tunis these lacto-reactions are highly thought of and are in daily use. Anomalous reactions of various kinds have been described, and in Malta, Martel, Tannon and Cretion state that as a means of diagnosis it is unreliable. Kennedy recently called attention to the fact that milk from cows in London, in some cases, would cause this reaction. Bassett-Smith<sup>1</sup> has made a study of this subject to determine, if possible, what error of technique had been committed to give rise to these misleading results. After considerable study he found, using 48 hour culture for an emulsion and dilution of 1 to 20, that none of the milk gave a positive reaction when examined quite fresh. He found that mixed samples of milk gave a high proportion of reactions at this dilution, but if the milk was heated, or diluted with distilled water instead of saline solution, the reaction was not present. He believes that with any method there will be a certain percentage of errors, and that it is possible that some cow's milk has a natural tendency to agglutinate this organism. He believes that the diagnosis of the disease should always be controlled by some other procedure.

**Measles. THE EARLY DIAGNOSIS OF MEASLES.** To be of any use in preventing the spread of the infection, particularly in the case of schools, hospitals, or other institutions, the diagnosis of measles must be made early. The presence of Koplik spots enable us to make a correct diagnosis a very little earlier than under ordinary circumstances, and the progressive loss of weight during the period of incubation may be made use of where measles are suspected. Another suggestion, which is not a new one, was made by Lucas.<sup>2</sup> He made a study of 19 cases, 9 of which developed measles, and 10 did not. He came to the conclusion that blood examinations in cases of suspected measles were of definite value. There is an early change in the blood picture, which may be taken as the first evidence of infection. This consists of a diminution in the lymphocytes, which normally predominate in infant's blood, and a relative increase in the percentage count of the neutrophiles. There is an actual diminution of both lymphocytes and neutrophiles, but the diminution of the lymphocytes is greater than that of the neutrophiles, so that the normal blood picture is entirely changed. In normal infants, the lymphocytes vary between 55 and 70 per cent. of the white cells, the neutrophiles from 25 to 30 per cent. This change usually begins a week before any visible symptoms of infection occur.

In measles, there is a definite, constant leucopenia which sometimes starts eight days before any physical signs, but which sometimes only appears simultaneously with them. For this reason, it is not so reliable

<sup>1</sup> *The Lancet*, March 14, 1914, p. 737.

<sup>2</sup> *American Journal of the Diseases of Children*, February, 1914, p. 149.

a diagnostic method as counting the cells with a view of determining the percentage of the different forms. Along with this there is an increase in the number of disintegrated cells, which probably is not specific in measles, but, taken with the reversal of the blood picture, helps in the diagnosis.

By making blood examinations in suspected cases, where other children are present (as in hospitals), it should be possible to reduce the incidence of measles considerably.

There are several other points of interest that have been brought out by various observations, and which have been summarized by Lucas.<sup>1</sup> The eosinophiles disappear during the eruption, and show a decrease even in the incubation which begins usually three or four days before the eruption. During incubation, decided and periodic variations occur in the bearing up of the leukocytes in which all the stages of disintegration cannot be followed. The Arneth formula is also disturbed, there being a divergence to the left which begins, on an average, four days before the eruption, and about two days before the Koplik spots appear.

**THE CAUSE OF DEATH IN MEASLES.** Thursfield has made an extensive study on this subject from work done in several of the London hospitals. In England, the adult forms a very small proportion of cases affected with the disease, and a still smaller number of the fatal cases. In the year 1910, less than 5 per cent. of the deaths were in persons over ten years of age. This immunity of the adult population is largely due to the protection afforded by an attack of measles during childhood. The number of deaths from the disease, however, is very large, and for England and Wales the average annual mortality for the ten years ending with 1910 was over 11,000 at all ages. It is difficult to obtain the percentage mortality of those attacked, but it is generally admitted that it increases with unfavorable conditions of life. The mortality among the children of the prosperous, well-housed class is small. Ker states that the death rate has decreased in Edinburgh since the hospital accommodations were improved. He estimates the percentage at all ages during nine years of compulsory notification as 4 per cent. of some 38,000 cases.

In some of the infants' hospitals in Paris, the mortality has reached 40 per cent. or more. Death from measles is usually due to accompanying lesions, and it has been stated that the mortality of the uncomplicated cases is almost negligible. The disease has been transmitted to human beings experimentally by Hektoen, and still more recently by Goldberger and Anderson, and it has been found that the virus of measles may pass through a Berkefeld filter, that it loses its virulence after the stage of eruption, that it is present during

<sup>1</sup> American Journal of the Diseases of Children, December, 1914, p. 412.

the eruptive stage not only in the blood but in the secretions of the mouth and nose as well. It loses its infectivity by exposure to heat, but it resists cold to a considerable extent.

THE COMPLICATIONS OF MEASLES are numerous and the most frequent is bronchopneumonia. Kien records that, of a series of 1205 cases, bronchopneumonia occurred in 166 patients, of whom 134 died; a bronchopneumonia mortality of 80 per cent., forming 63 per cent. of the total mortality in the series. Heissler, in an epidemic of 2874 cases with a mortality of 1.23 per cent., notes that, in 35 fatal cases, 33 were due to bronchopneumonia. Thursfield found that in 324 cases there were 29 deaths, 16 of which were attributed to bronchopneumonia or pneumonia, amounting to 55 per cent. Pulmonary complications were present in about 25 per cent. of these cases. Diphtheria is perhaps the next most dangerous complication. It frequently occurs either simultaneously or after the measles infection. The Metropolitan Asylum Board Statistics for 1911 show that the percentage for measles complicating diphtheria is 1.88 per cent. of 3184. Thursfield did not find any deaths due to diphtheria in his series, but it was present as a complication and no doubt as a contributory cause of death in 4 of the fatal cases. Diarrhea also was a cause of death, particularly that coming on during convalescence. The diarrhea occurring during the eruptive stage is commonly harmless. The relation of tuberculosis in measles is one about which a considerable amount has been written and it is quite probable that the measles lowers the resistance so that subsequent infection to tuberculosis is more common than in healthy children. Thursfield, from careful post mortem investigation of patients dying from measles, found that there was not only no pulmonary tuberculosis but that there was no evidence of tuberculous infection of the lymph nodes. In a further series of 29 deaths, there was one instance of a gross tuberculous bronchopneumonia which was believed to be present before the infection of measles. This would seem to make it clear that if measles predisposes to tuberculosis, infection must take place late in the convalescent period and this observation of Thursfield coincides with the clinical facts.

Bacteriological studies were made of 34 cases of children dying of measles and its complications. The average age of these patients was just under two years. It is very interesting to note that the most marked infection was the streptococcus. It was found alone or in association with other organisms in 18 out of 30 cases. In 9 cases it was found in the pure culture in the heart's blood, and 7 presented in life the severe symptoms of bronchopneumonia with high fever. It has generally been assumed that the pneumonia and measles were due to the pneumococcus. These studies of Thursfield and also the studies of other observers make it rather clear that most of the fatal cases show the presence of the streptococcus in pure culture. Thus, Lorey, in

1909, found it in 17 out of 22 cases, and in 15 of these it was in pure culture. Strauch found it in the heart's blood in 18 out of 31 cases, and six times in pure cultivation. Eyre made a study of 20 cases of bronchopneumonia in measles and found the streptococcus in 13, five times in pure culture. As regards infection with the pneumococcus, it would seem that in cases which developed bronchopneumonia early, either before or coincident with the eruption, this was usually due to the pneumococcus, whereas the cases developing late in the disease were generally due to the streptococcus. It is also quite possible that the influenza bacillus may play a considerable role in causing death in measles. Organisms of the influenzal type are very common in secondary or tertiary infections. They are rarely found in sufficient numbers or in a sufficient state of purity to suggest their being the primary cause of death, but they no doubt contribute to it. In this connection it is interesting to note the conclusions of Lorey:<sup>1</sup>

1. The streptococcus pyogenes is the most frequent cause of complications in the course of measles.

2. The severity of an epidemic of measles is determined by the frequency of the secondary infections with streptococcus pyogenes.

3. The discovery of considerable quantities of streptococci in the fauces indicates a secondary infection and makes the prognosis gloomy. If streptococcus pyogenes can be grown from the blood, one must almost invariably expect a fatal issue.

4. The primary focus of the secondary infection is the upper air passages.

5. Pseudocroup appears to be a pneumococcus infection.

**A Disease of the Sublingual Glands Resembling Mumps.** Hegler<sup>2</sup> has observed 8 cases in which there was a swelling of the sublingual glands. Seven of the cases were in nurses in a hospital, and the eighth in a patient, and cases resembling these were also noted at the same time outside the hospital. There were no typical cases of mumps at this time and none of the people coming in contact with the patients developed mumps, so that Hegler is inclined to the opinion that the disease was not mumps but some other infection. The disease came on suddenly without any prodromes. There was general malaise, headache, drowsiness, some pains in the muscles and slight fever. These general symptoms did not last long. Examination of the blood showed a slight leukocytosis. The most pronounced symptom was swelling in the floor of the mouth, which lasted from one to two weeks. The swelling was sufficiently great to suggest a double chin, the sublingual folds were prominent, and, in one case, the right submaxillary gland was apparently involved.

**Intestinal Myiasis.** From time to time, there are cases of myiasis reported in the journals. Among the very rare infections is that with

<sup>1</sup> Zeitschrift f. Hygiene, vol. lxiii, p. 135.

<sup>2</sup> Beitrage zur klinische der Infections Krankheiten, 1913, p. 229.

the *Anthomyia canicularis*, which is the larva of a small, black flower fly, known as the *Anthomyia pluvialis*. Blankmeyer<sup>1</sup> has reported a case, making the second one which he has reported. In 1907, at the time of his first report<sup>2</sup> there were 17 cases on record, 5 having been reported in America, 5 in Germany, and the remainder being divided between France, Sweden and Argentina.

The patient in question was a woman, thirty-two years of age, who had lived on a farm most of her life. Her illness had begun about fifteen years before. She was treated for various diseases, and, after several months illness, began passing larvæ. Among the most important symptoms were nausea and vomiting, and there was also abdominal tenderness, and occipital headaches. While in poor health, with occasional temperatures of 101°, she was able to be up and around the house, and to do light work. The customary parasitocides were used without marked benefit, and the subsequent treatment consisted of sulphate of magnesium and 5-grain doses of salol. There has been some improvement but she still passes from four to fifty larvæ per day. Unfortunately, the author does not state what parasitocides have been used.

**Paragonimiasis.** Among the diseases which the United States Health Service has reported, we find paragonimiasis. This disease is one which is deserving of considerable attention, as, with the increased traffic with the East, it is liable to be imported into this country and it is quite possible that the disease is generically related, if not specifically identical, with a disease affecting hogs in the United States. In other places it affects other animals, and in PROGRESSIVE MEDICINE for March, 1912, I called attention to a closely allied disease found in sheep and, incidently, in man in Great Britain. The condition is known under a great many different names, depending largely upon the part of the world in which it is found and the animal affected. The disease, as it occurs in man, is a native of Japan and China, although it has been seen in other parts of Asia and the neighboring islands. Inasmuch as it is apt to affect the lungs, it is generally referred to as *pulmonary distomatosis* or *lung fluke disease*. Infections of other parts of the body may occur secondarily. The parasite was described by Kerbert, in 1878, and called the *Paragonimus westermanii* (*Distoma westermanii*). Subsequently, it was described by various Japanese investigators and given various names. The parasite is supposed to enter man with contaminated food or water, and later the parasite localizes in the lung. The symptoms come on very slowly, and eventually become characterized by cough and hemoptysis and the disease is recognized by the presence of the ova in the sputum. It is generally confused with tuberculosis, from which it may be separated by a micro-

<sup>1</sup> Journal of the American Medical Association, July 29, 1914, p. 321.

<sup>2</sup> Ibid., May 14, 1907, p. 1505.

scopic examination of the unstained sputum. The eggs are generally present in such numbers as scarcely to be overlooked. There are a number of other trematode diseases in man caused by similar parasites, one affecting the liver with secondary involvement of the spleen and intestine, one affecting the intestine, one the veins, and occasionally the eye may be affected secondary to one of the other forms.

**The Parameningococcus.** Since Dopter announced his discovery of the parameningococcus, there has been a considerable amount of work done on this subject, and Darre and Dumas<sup>1</sup> have contributed an article on this subject in which they show that there is not only one group of parameningococcus, but two, or possibly even more. The germ which they have succeeded in isolating differs from that of Weichselbaum and from the parameningococcus of Dopter. The organism differs in some of its characteristics, chiefly its reactions. Dopter and Pauron have stated that these observations are in perfect accord with the results of certain studies which they have made on the agglutination reactions of the parameningococcus. The organisms are to be distinguished by the reaction caused by antimeningococcus serum which has been saturated with agglutins in addition to the tubes ordinarily used, and for the agglutination reaction an additional tube is used containing the saturated serum. If the germ is agglutinated by the two specific serums, and if in the saturated serum there is no agglutination, the organism is a meningococcus, while if it is agglutinated in the saturated serum, it is a parameningococcus. Darre and Dumas have used this same test for distinguishing other organisms.

**MENINGITIS DUE TO THE PARAMENINGOCOCCUS.** Vallery-Radot<sup>2</sup> has reported a very interesting case of the infection of the meninges with the parameningococcus. The patient was a young girl who had cerebrospinal fever. In spite of three injections of 120 c.c. of antimeningococcus serum, the symptoms continued to grow worse and there was no change in the character of the cerebrospinal fluid. The patient was then studied with a view to its being a parameningococcus, and 40 c.c. of antiparameningococcus serum were injected. The following day there was an improvement in the symptoms and in the appearance of the cerebrospinal fluid. During the three following days, three additional injections of this serum were used and, in all, the patient received 145 c.c. After each injection the condition of the patient improved and after a few days the cerebrospinal fluid had returned to normal.

**Paratyphoid Inoculation.** There have been very few observations made upon the use of vaccines for the prevention of epidemics of paratyphoid. Castellani<sup>3</sup> has shown that certain strains of paratyphoid

<sup>1</sup> La Semaine Médicale, July 1, 1914, p. 309.

<sup>2</sup> Ibid., July, 1914, p. 308.

<sup>3</sup> Journal of the Ceylon Branch of the British Medical Association, October, 1914.

bacilli lose their virulence when heated to 50° C., and Broughton-Alcock<sup>1</sup> working in the Pasteur Institute in Paris, used a vaccine composed of a number of different strains of typical paratyphoid bacilli. These were all separated from the blood of patients. In the first experiments the reaction following the injection gave rise to considerably more local disturbance than either typhoid vaccines or those prepared from paratyphoid A. They were, however, always of short duration, never lasting beyond thirty-six hours. In the earlier experiments, if unheated bacilli were used, there was an occasional formation of an abscess, lasting sometimes as long as five weeks. With sensitized virus made from heated bacilli, the reactions are slight, and it is possible to produce a satisfactory degree of immunity by the use of them. With these vaccines a large number of individuals were treated in the Villejuif hospital in order to prevent the spread of the disease which had occurred. This procedure has been used by Cummins.<sup>2</sup>

Leishman has shown that antityphoid vaccination does not prevent paratyphoid A, and it has been shown that paratyphoid B infections may occur after attacks of typhoid fever, so that the immunity of the various groups seems to be separate.

The greatest interest centring in these experiments is the possibility of finding one member of the paratyphoid group which would give immunity to all the different strains. When an epidemic is present, of course, one could use a vaccine made from the particular bacillus causing the disease. But, in the absence of trained workers to determine this, it would be of decided advantage to have an effective paratyphoid vaccine.

**Pellagra.** So far, the question as to whether pellagra is an infectious disease or not has not been settled, in spite of the numerous studies that have been made. There are two distinct schools of thought; one believing that the disease is transmissible, and the other that it is merely a disturbance of nutrition. I reviewed last year a number of articles dealing with the facts that had been brought forth to show these views, and commented on the views of Sambon and others. Among those who belong to the other class may be mentioned certain members of the Public Health Service, and Goldberger<sup>3</sup> has called attention to one fact concerning the disease which is not explained by assuming that pellagra is transmissible. This fact which he emphasizes has been known for many years, namely, that in asylums and hospitals where there are a large number of cases of pellagra, the attendants and nurses practically never develop the disease, although they live under conditions which are identical with those of the affected individuals.

In Italy, contact with the pellagrins is not avoided, and the Italians

<sup>1</sup> The Lancet, September 19, 1914, p. 743.

<sup>2</sup> Royal Army Medical Corps Journal, September, 1913.

<sup>3</sup> Public Health Reports, June 26, 1914, p. 1683.

believe, from long experience, that there is no danger whatever of the disease being transmitted from the sick to the healthy in any of the institutions in which pellagra is treated. The disease is very distinctly rural in its character, and it is also agreed that it is very largely associated with poverty. Goldberger believes, with many others, that the disease is nutritional and, from the study of the dietaries of certain institutions, he thinks that vegetables and cereals form a much greater proportion in them than they do in the dietaries of well-to-do people. He does not believe that the consumption of corn or corn products is essential to the production of the disease. As a preventive measure he urges a reduction in cereals, vegetables and canned goods that are used so extensively by the people in the South and an increase in the use of fresh animal foods, such as fresh meats, eggs, and milk. With the apparent rapid increase of the disease in this country, it seems imperative to continue the work of the commissions investigating this disease, and it should be studied from every standpoint with a view of determining the causal factor.

In a letter to the Surgeon-General of the Public Health Service, Goldberger<sup>1</sup> reports briefly some facts concerning the *etiology* of this disease. The progressive and alarming increase of the disease in the United States had led to a large number of physicians and most of the laity believing that the disease is transmissible.

Lavinder and Francis have made a series of experiments which consist in inoculating into the monkey every kind of tissue secretion and excretion from a considerable number of grave and fatal cases of pellagra. The inoculations have been made in every conceivable way in over one hundred rhesus monkeys, and, so far, all the results have been negative. Francis, at the suggestion of Goldberger, has been making a culture study of the blood, secretions and excretions of pellagrins, using the latest anaërobic methods, but up to date there have been all negative results.

Willets and Waring have made epidemiologic studies at the Georgia State Sanatorium, and later at an orphanage in Jackson, Mississippi, and while the studies have not been completed, the results of the investigations made by these physicians with officers of the Public Health Service show that in the Georgia Sanatorium there were 996 patients during 1910; if we exclude those who died, were discharged during the first year, or had pellagra on admission, or within a year of admission, there remained at the institution, after one year, 418, and of this number, 32, or 7.65 per cent. have developed pellagra. There are 293 employes who have been in more or less intimate association with pellagrins and who have lived in substantially the same way and in identical environments for at least one year. If pellagra had developed among these employes at the same rate at which it exists among the inmates, then

<sup>1</sup> Public Health Reports, September 11, 1914, p. 2354.

22 of them should have the disease, while, as a matter of fact, not a single one has developed it.

In the Jackson orphanage, there were 211 orphans, of which 68, or 32 per cent. had pellagra. Most of the cases were among children between the ages of six and twelve, of whom 58 per cent. were infected. In a group of 25 of the children under six years of age there were 2 cases, and in a group of 66 over twelve years of age, there was but one case. Inasmuch as all of these children had been living under identical conditions, the remarkable exemption of the younger children can hardly be explained by any process of infection. A minute investigation of both institutions shows that the only constant difference discoverable related exclusively to the diet. At both institutions, those who were found to subsist on a better diet were not among the affected groups. Those who developed pellagra had small amounts of meat or other protein food, and the difference was made up by vegetables and other food, of which corn syrup was an important constituent. Until practical tests can be made to show that no pellagra develops in those that consume a mixed and varied diet, our judgment in regard to the etiology has to be suspended pending the submission of further data.

Loring<sup>1</sup> found that pellagrins, fed on a very generous diet, in which eggs, milk, and fresh foods form a large element, improve markedly, the mental and nervous symptoms improving first, and there was improvement within two weeks of the intestinal conditions. The skin manifestations were slow in disappearing. His experiments were made at the Georgia State Sanatorium, but the cases were too few to draw any definite conclusions. It is interesting to note that, as a result of these experiments, one can say that the diarrheal conditions are not made worse by the generous diet.

Among the more recent theories in connection with pellagra is that of Alessandrino and Scala of the presence of silica in colloidal solution. The relation of silica to the disease has not been noted before, but in certain parts of various countries, particularly Italy, the disease has been noticed to follow certain streams. The observations made above in the Georgia State Sanatorium and at the orphanage at Jackson, Mississippi, would seem to show that drinking water is not a factor in the problem of the causation of pellagra.

A second report of the Thompson, McFadden, Pellagra Commission has been published by Siler, Garrison, and MacNeal.<sup>2</sup>

A summary of this first report was made in *PROGRESSIVE MEDICINE*, March, 1914. In the first report they stated that they had found no specific cause for pellagra, and that infection by maize products did not seem to them to be the essential cause of the disease. They were inclined to believe that it is a specific infectious disease, communicable

<sup>1</sup> Public Health Reports, September 11, 1914, p. 2357.

<sup>2</sup> Journal of the American Medical Association, September 26, 1914, p. 1090.

from person to person, by means, at the present time, unknown. They were unable to incriminate any of the species of simulum, and they doubt if any insect can be blamed with the transmission, except possibly the *Stomoxys calcitrans*. They were also inclined to believe that the contamination of the food with the excretions of pellagrins was a possible mode of the distribution of the disease. They found a comparative freedom from the disease under the age of two years, in adolescence for about five years following puberty, and among adult males in the active period of life. The disease was found with great frequency in children from two to ten years of age, in women from twenty to forty, and in old persons of both sexes.

Voegtlin<sup>1</sup> believes that the disease is a chronic intoxication, and that the agents responsible for this poisoning are not known at the present time. He believes that there are toxic substances in certain vegetable foods, not necessarily spoiled, which, if consumed by man, after a long period of time, may produce an injurious effect on certain organs of the body. He has carried on dietary experiments with the lower animals, such as rats, mice, and monkeys, and they show that on an exclusive vegetable diet, they may die, sometimes in a remarkably short period of time, from an intoxication, with the development of certain gastrointestinal symptoms. This result has followed an exclusive diet of corn, carrots, sweet potatoes, oats, and other vegetables. Some laboratory experiments seem to point to the fact that extracts from these vegetable products, if fed or injected into animals, produce the same symptoms.

Fischer, Abderhalden, Mendel, and Osborne have shown that there are great variations in the contents of protein in regard to the amount of the various amino-acids. It has been demonstrated that all proteins are assimilated to about the same degree, but some proteins lack, or are deficient in certain of the amino-acids, which are essential to the growth and maintenance of nutrition. A similar deficiency may exist in vegetable proteins, and Voegtlin thinks that it is possible that pellagra may be due to the use of a diet deficient in these amino-acids; or that it may be due to the toxic effect of some substance, such as aluminum, occurring in certain vegetable foods. The theory of Alesandrino and Scala concerning the evidence of colloidal silica is interesting in this connection.

Funk has recently studied the occurrence of certain substances in foods, that apparently are present in very small quantities, but which are essential for nutrition. These are called vitamins. In certain foods vitamins are present in small amounts while certain others are found to be relatively rich in these substances. Funk believes that pellagra is a disease due to a deficiency or absence of certain vitamins

<sup>1</sup> Journal of the American Medical Association, September 26, 1914, p. 1094.

and that it is analogous to beri-beri, which is produced by the more or less exclusive use of polished rice. No definite connection could be made out between *occupation and the occurrence of pellagra*; from the large number of children and women, and old persons infected, it would seem that the disease was possibly contracted in the home. Eighty per cent. of the cases were found to be associated more or less closely with pre-existing cases. There is no evidence that pellagra is an inherited disease. The year's work did not bring up anything new in regard to the Simulium. They believe that it had nothing to do with pellagra, and none of the animal inoculations or studies upon the intestinal bacteria have produced any results. They find that in the blood in many cases there is a lymphocytosis, but not of abnormal constancy. In adults, good results have been obtained by hygienic and dietetic treatments, but most of the cases have recurred after returning to their former environment. In children, they find the prognosis to be much more favorable.

**EXPERIMENTAL PRODUCTION OF PELLAGRA IN THE MONKEY.** Various experiments were made to produce pellagra in animals, and Harris<sup>1</sup> has reported an interesting experiment made in 1910. Material from a fresh necropsy in a case of studied pellagra which presented clinically a typical picture of the disease was used to make a filtrate, using a Berkefeld filter. This filtrate was injected subcutaneously, intravenously, and intracranially in large quantities into a full grown *Macacus rhesus*. The monkey recovered from the operation, but showed immediate pressure symptoms, which passed off, and for several months after was apparently normal, when he developed irregular dark patches on the face, hands, and sides of the body. The length of time from the development of the disease in this animal led to the belief that it may not have been due to the injection, and the experiment was not repeated.

In 1912, a similar experiment was made, and early in 1913, a third experiment was made. Monkey No. 2 which had received two inoculations, one in December, and the other in February, early in May began to show irregular patches of a coppery or dusky red color on the jaws. Subsequently skin lesions appeared, almost black in color, which became scaly and fissured. The third monkey, inoculated in February, in May showed copper-colored spots upon the face.

**CEREBROSPINAL FLUID IN PELLAGRA.** This has been studied by a number of different observers, and recently by Loring.<sup>2</sup> He found that there is no lymphocytosis in the cerebrospinal fluid of the patients who have uncomplicated pellagra and that an excess of globulin is only occasionally observed. This fact, taken together with certain other observations, would seem to be in accordance with the suggestion that pellagra is not an infectious disease of the central nervous system.

<sup>1</sup> Journal of the American Medical Association, June 21, 1914, p. 1948.

<sup>2</sup> Public Health Reports, September 11, 1914, p. 2360.

These findings are also in accordance with the most recent studies upon the histopathology of the nervous system in pellagra, as is evidenced by the work of Motte, and of Singer and Pollock.

**Plague.** THE DIAGNOSIS OF PLAGUE. There have been a number of suggestions made with regard to the diagnosis of plague, most of which are the use of blood cultures and the agglutination reaction. The former seems to be of very definite value, the latter of little or no use. Schöbl, in studying the disease in the Philippines, found that fourteen out of fifteen patients gave positive blood cultures. In some of these patients, the disease did not show signs of buboes or involvement of the lungs. Where the buboes were already formed, he found that the diagnosis of plague could be made in most cases by a microscopic examination of the fluid obtained by puncturing the bubo. The length of time in which the bacillus of the plague circulates in the blood has not been definitely determined, although it would seem that it is rather short and irregular. In some instances other organisms, such as the streptococcus or pneumococcus may be obtained at the same time. The agglutination test can not be obtained in the first week or at any rate with the technique now in vogue. It may, however, be found in convalescent patients and its present stage of involvement is of no particular value.

**THE PREVENTION OF PLAGUE.** A very trite saying is that "an ounce of prevention is worth a pound of cure," and the city of Mobile has decided to profit by the experience of New Orleans in the situation brought about by the outbreak of bubonic plague. Grubb<sup>1</sup> has given an account of the work done under his supervision which consisted in the catching and extermination of rats, and the rat-proofing and other methods of preventing these pests from over-running the wharf districts of the city. In addition to the large number of rat catchers, rat guards were required on all steamship lines, and vessels had to be fended off eight feet, and skids and gangways were removed when not in use. During the month of September, the rat catchers caught 2393 rats. The rat-proofing was carried out under the provisions of an ordinance passed which prescribed in detail how this should be done.

The value of doing this work before an epidemic, of course, is apparent. Rat catching is very expensive, and it is much better to use rat-proof buildings in construction than to attempt to keep the number down under ordinary conditions. Quite apart from any value in preventing plague, the rat-proofing of buildings is very advisable because it eliminates the destruction of property by these rodents, decreases the fire insurance rates, and does away with the delay and expense of repairing the more easily destroyed structures.

This is work which could be followed out to great advantage in all

<sup>1</sup> Public Health Reports, November 6, 1914, p. 2967.

seaport towns, and even in others. The destruction of property by rats in the United States has been commented upon as far exceeding the amount that would ordinarily be estimated.

**PLAGUE AND FLEAS.** A study of the epidemiology of plague has been made by Bacot and Martin.<sup>1</sup> The part which the flea plays in the transmission of the plague has been a matter of a considerable amount of theory and experimentation ever since the association of the two was announced in 1897. It was first demonstrated that the disease could be spread from rat to rat by means of flea bites and also that the puncture wound that the flea makes was capable of infection with the plague bacillus by the application of infectious material to the bitten areas. The authors make the following summary of their work:

Under conditions precluding the possibility of infection by dejecta it was found that two species of rat fleas, *Xenopsylla cheopis* and *Ceratophyllus fasciatus*, fed upon septicemic blood, can transmit plague during the act of sucking, and that certain individuals suffering from a temporary obstruction at the entrance to the stomach were responsible for most of the infections obtained, and probably for all.

In a proportion of infected fleas the development of the bacilli was found to take place to such an extent as to occlude the alimentary canal at the entrance to the stomach. The culture of pest appears to start in the intercellular recesses of the proventriculus and grows so abundantly as to choke this organ and extend into the esophagus. Fleas in this condition are not prevented from sucking blood as the pump is in the pharynx, but they only succeed in distending an already contaminated esophagus, and, on the cessation of the pumping act, some of the blood is forced back into the wound. Such fleas are persistent in their endeavors to feed, and this renders them particularly dangerous. Fleas suffering from obstruction do not necessarily perish, and in course of some days the culture obliterating the lumen of the proventriculus may autolyse and the passage again become pervious. They are, however, incapable for the time being of imbibing fresh fluid, and are, therefore, in danger of drying up if the temperature is high and the degree of saturation of the atmosphere low. Although, as far as our observations go, they withstand desiccation quite as well as normal fleas which are not fed, their length of life must be short directly hot, dry weather sets in, and we are led to wonder whether this fact may not, to some extent, explain why in India epidemic plague is confined to the cooler and moister seasons, and particularly why in Northern and Central India the epidemics are abruptly terminated on the onset of the hot, dry weather.

**Pneumonia.** PROPHYLACTIC INOCULATIONS AGAINST PNEUMOCOCCUS INFECTIONS. Wright<sup>2</sup> working in connection with Morgan, Kolbach

<sup>1</sup> Journal of Hygiene, Supplement III, Cambridge, 1914.

<sup>2</sup> Lancet, January 3, 1914, p. 1, and January 10, 1914, p. 87.

and Dodgson, has made a contribution to this subject as the result of an inquiry into the causation, prophylaxis and treatment of pneumonia which affects the native laborers in the Rand mines. This report is a continuation of one made two years ago. They gave more or less in detail the results of their rather extensive experiments. They found that, as far as the treatment of pneumonia itself by vaccines was concerned, in small doses frequently repeated pneumococcus vaccines were absolutely ineffective, and that, on the other hand, the inoculation in the form of a single large dose administered at the incubation period often arrested the disease and averted death. They also studied the question of using the vaccines as a prophylactic and they found that the tropical native laborers of the Rand are not as resistant and do not react as well to the injections as the laborers in some of the other mines. They were able, however, to effect a reduction varying from 31 to 60 per cent.; the observations being mostly over periods of six months. They found that individuals who had not been exposed to the infection gave better results than those who had already been exposed for some time. Pneumonia in the Rand presents a number of interesting features. It is unknown or practically unknown in the native villages, and seems to have no special relation to the mining work on the Rand, nor is the mortality any greater in the deep mines than in the open ones. There does not seem to be any special relation either to climate or elevation above sea level. The disease is very prevalent among the natives working in the mines and particularly so in the newly arrived natives; the crowding together of people with a low power of resistance is probably responsible, in a measure, for the prevalence of the disease. Wright and his co-workers believe that the cases should be isolated, and the quarters from which the cases had been removed disinfected. They also suggest certain changes in the hygiene of the workers, particularly relating to sheds in which the natives change their clothes; particularly, they recommend prophylactic inoculations of a dose of one thousand million pneumococci cultivated upon glucose blood broth and that this dose be repeated at the expiration of four months. It will be exceedingly interesting, if these inoculations are carried out, to see what effect they have on a disease which so far has not yielded to any method applied to prevent it.

The large death rate of the natives employed in the Rand mines led the Chamber of Mines to invite Dr. W. C. Gorgas to make an investigation. His report<sup>1</sup> is full of interest. The death-rate in 1903 was 71.1 per 1000, but this has been gradually reduced so that, in 1912, it was 26.8 per 1000. At the Panama Canal the death-rate among the negroes was only 10 to 1000. Pneumonia and tuberculosis were the chief causes of death, but meningitis and typhoid fever had also to be con-

<sup>1</sup> Journal of the American Medical Association, June 13, 1914, p. 1855.

sidered. The comparison of the condition of the Rand to the Canal Zone brings out several points in connection with the incidence of pneumonia. It was found that in the Canal Zone no house had a particularly high rate, but the rate would vary from time to time. It varied also with regard to the season, sometimes being worse in the wet season, sometimes in the dry. Inasmuch as the men worked continuously in the rain, and went home soaked, some being so poor that they did not have a change of clothing, a study was made with reference to the coincidence of pneumonia and this question of clothing. It was found that those who slept in dry clothing had pneumonia just as much as those who slept in wet. In the barracks there were tiers of bunks, and the arrangement was such that the top bunk had much more draft than the lower. The rate of pneumonia in the top bunk was no greater than in the lower. It was also found that the altitude played no part in the production of the disease, the only difference in the susceptibility seemed to be according to the length of time that the laborer had been on the Isthmus. The same number of men who had been on the Isthmus for over three months who furnished 2 cases of pneumonia, would give 9 cases if they had had less than three months' residence. It was argued from this that the question was one of immunity, and that the negro who had been living on the Isthmus for three months or more acquired a certain amount of immunity. The fall in the death-rate of pneumonia on the Isthmus, coincides with the order which allowed the laborers to leave the barracks in which they had been housed and to build cabins for themselves on the hills, or to live in the towns of the Canal Zone and bring in their families. The overcrowding in the barracks; led to the inflammation of the upper air passages and this sometimes amounted to epidemics in which there were a large number of cases of pneumonia. The question of direct infection also probably played a certain role, and the pneumococcus was transferred from person to person by means of eating utensils, vessels used for drinking, as well as water taps.

The death-rate from tuberculosis Gorgas regards as too high, and he suggests that the same measure which would control the pneumonia incidence would also affect the tuberculosis rate.

There has been an increase in miners' phthisis, but efforts are being made, by means of water-spraying apparatus, to reduce the amount of dust, and this will probably be effective in preventing the silicosis which is the forerunner of tuberculosis in those cases.

The cerebrospinal fever can probably be best combated by scattering the cases, together with isolation and disinfection. Typhoid fever could be taken care of by using the vaccine.

As far as the Rand is concerned, Gorgas proves that the housing condition probably plays a greater part in the disease than any other one factor, and he advises the scattering of large barracks into single huts

and also introducing the families of the natives. Numerous other factors regarding the sanitation have been considered by Gorgas which need not be gone into here, but his report is a model of brevity and clearness.

**TREATMENT OF PNEUMONIA WITH PARTIALLY AUTOLYZED PNEUMOCOCCI.** Among the numerous articles which have been contributed on the study of pneumonia, is one by Rosenow and Hektoen.<sup>1</sup> Rosenow had previously shown that when virulent pneumococci are suspended in physiologic salt solution, the substance or substances on which their virulence and resistance to phagocytosis depend, pass into solution. The result is that the soluble part, at a certain stage of the process, is found to be very toxic, but with little immunizing action, while the insoluble part is practically non-toxic and possesses antigenic properties. The protective value of these non-toxic substances against experimental pneumococci infections has been found to be greater than that of heat-killed pneumococci. Experiments have been made to determine whether this substance has any affect on the course and death-rate of lobar pneumonia. The experiments began in 1911 and slightly different methods were employed in making these substances during different years. The dose of the detoxicated pneumococci was started between 10 to 20 billion and injections were given subcutaneously daily until the temperature reached normal. During the second year of the experiment, in 1912, only one injection of approximately 20 billion was given as soon as the diagnosis was established, and during 1913, 10 to 15 billion were given daily until the temperature reached normal. There is no general reaction and only a slight tenderness following an injection.

The cases treated may be divided into three classes; those treated outside of the hospital, the uncontrolled cases in the hospital, and those controlled by alternate untreated cases. The results of 30 cases treated outside of the hospital were better than those obtained in the hospital. Three of these patients died, one had a large number of influenza bacilli and streptococci in the sputum, and one had a high grade of emphysema, due to a bronchial asthma of long standing. In 35 cases treated in the hospital, 9 died, a large number of fatal cases being in alcoholics. In the third group, every other pneumonia patient admitted into the hospital was treated with the detoxicated pneumococci, and, in addition, was given the usual routine care common to all pneumonia patients. There were 294 cases, 146 receiving the injections, and 148 constituting the controls. Of the injected group, 34 died, a death-rate of 23.3 per cent. and, of the controlled, 56 died, a death-rate of 37.8, the mortality of the injected group being 14.5 per cent. lower than in the uninjected. The results obtained by this method of treatment seem to warrant a further use of it and it may be possible, by varying the technique, to increase its efficiency.

<sup>1</sup> Journal of American Medical Association, December 20, 1913, p. 2203.

THE SERUM TREATMENT IN PNEUMONIA. The subject of producing a serum which would be useful in the treatment of pneumonia is one which has been studied with a great deal of attention, and, as early as 1904, Anders collected reports from 535 cases of lobar pneumonia treated with serum obtained from animals immunized to the pneumococcus. From his observations, Anders concluded that at that time the serum of pneumonia was of no value in the treatment of pneumonia, at any rate as then applied, and he stated that the method could not be recommended for general use. Since then, numerous contributions have been made to the subject, and while the mortality rate has not been definitely lowered, with certain cases it seems that the results were shown in the clinical course of the disease.

It has been shown that the serum of patients who were convalescent from pneumonia have not any bactericidal properties for the pneumococcus, or, at any rate, none that may be taken into account. The action of the serum in pneumonia seems to be largely bactericidal, and this is due to what have been called bacteriotropins. In normal serum the pneumococcus is not acted upon by the phagocytes, but, in the presence of immune serum, a very marked phagocytic action may be observed.

A most important advance was made, in 1909, by Neufeld and Händel. They found that the difference in the reactions in pneumonia serum was due to the fact that there are various strains of the pneumococcus which can be separated. A serum produced by one strain has no effect upon infections produced by other strains. The subject has been further studied by Dochez and Gillespie, and they have grouped the strains or types into four classes, two fixed types, with distinct serological reactions; the third type, the pneumococcus mucococcus for which no serum has, as yet, been found; and a fourth group, which, while nearly corresponding to the pneumococcus mucococcus, does not have the same serological reactions as the first two fixed types. It is quite possible that this fourth group contains a number of different strains. The pneumococcus serum will not act until a certain proportion is present in the body, and this degree of concentration Neufeld has called the *Schwellenwert*, or threshold, concentration, and doses often but very little smaller than this do not protect at all. It has also been shown in animals that there is a maximum degree of infection against which no amount of serum will protect.

This subject has been studied at the Rockefeller Institute by Cole, and he believes that, if he is able to determine the type of pneumococcus present in a case of pneumonia, by giving the homologous antiserum intravenously some results could be obtained. Following the work of Dochez, he has been able to produce an active immunity in animals for each one of the four groups, and an antiserum for the first, second, and fourth group. For the pneumococcus type, they have not, as

yet, produced an active antiserum. In order to determine into which group to place a patient, they have made cultures immediately from the blood, and also from a portion of the sputum coughed up from the lung, or, when this could not be obtained, a culture is made directly from the lung by an opening made by the insertion of a needle.

When large numbers of virulent organisms are present in the sputum, the cultures are more rapidly made by injecting these into the abdominal cavity of a mouse. After four or five hours the peritoneal cavity may be washed out with salt solution, and the cells thrown down in the centrifuge, leaving a suspension of the organisms. This may be tested with the agglutination reaction, and if the organism is found to be one of the first two fixed types, the treatment may be begun at once with the serum corresponding to this. This test has been worked out by testing the protective power of the serum, and they have been found to correspond.

In the first experiment, they used the serum in 20 cases. 2 of these patients died shortly after entry into the hospital, and 1 was shown later to be caused by type IV. Of the remaining 17 cases, 14 were due to the first type of organism, and 3 to the second type. Two cubic centimeters were injected subcutaneously to determine whether the patient was hypersensitive, and as soon as the type of organism was determined, 50 to 100 cubic centimeters, diluted one-half with salt solution, was injected intravenously. This was repeated at varying intervals, depending upon the patient's condition, but ordinarily, the solution was not given oftener than every twelve hours, and then the dosage varies from 190 to 460 cubic centimeters, although one case received 700 cubic centimeters. In 14 cases, due to the first type of organism, all recovered except one. In 3 cases due to the second type, one patient died, but in this case the patient objected to the treatment being thoroughly carried out.

A small series of cases like this is not sufficient to justify any definite conclusion, but it was shown that the serum has a marked bactericidal effect, and that, after one treatment, the blood of the patient was found to be sterile. In pneumonia untreated, the appearance of protective substances in the blood coincides with a fall in the temperature, and the disappearance of the symptoms. In the cases in which the serum is used, these protective substances appear shortly after the first injection. Neufeld has attempted to produce a serum by injecting various types of the organism into the same animal, but this has not yielded any very satisfactory results.

As far as this work has been carried out, it would seem to show that if any advances are to be made in the serum treatment of pneumonia, they will be made by studying the type of the pneumococcus causing the disease, and using the appropriate serum in each instance. For the present, this will necessarily limit the use of the serum to experimental

hospitals, inasmuch as the diagnosis of the type of organism causing the disease is exceedingly difficult, and can only be done by a laboratory expert. The work is exceedingly suggestive, and will doubtless lead to further results of a more practical nature.

**THE BLOOD PRESSURE IN PNEUMONIA.** For many years, the grave symptoms and deaths from pneumonia have been very largely regarded as due to failures of circulation, and therapeutic advances have been attempted very largely along the line of combating the failure of the vasomotor mechanism. This followed the experiments of Romberg, in 1889, who stated that the failure in the circulation was not due to changes in the heart muscle, but to the exhaustion of the medullary centres.

Newburgh and Minot<sup>1</sup> have attempted to restudy this subject, owing to the vast amount of conflicting evidence. The first study was made with a view to determining the blood pressure. They believe that if the bad symptoms are due to failure of the circulation, it ought to be possible to divide cases of lobar pneumonia into two groups, the first group including those in which the vasomotor apparatus is intact, and the second, those in which it is seriously injured. In the first group, the blood pressure measurement ought not to differ widely from those obtained in normal life, whereas in the second group it ought to fall well below the normal, and if the older ideas were tenable the blood pressure curve ought to furnish data of remarkable value both for prognosis, and as an evidence of the success of the therapeutic measures.

In 1911, Wiegert, in a study upon the blood pressure in various infections, found that no conclusions could be formed from the published reports, so variable were they. He studied 35 cases in which there were six deaths, and the pressure in these fatal cases was not low. In the cases which recovered, 6 showed no change in the pressure; in 9 others, there was a gradual fall of from 25 to 35 millimeters, reaching the lowest point, on an average of about the ninth day after the crisis, and being unaffected by it. In 3 cases, there was some falling which had no relation whatever to the crisis; in 12 cases, the blood pressure curve showed a progressive rise. His conclusions were that the blood pressure was of no prognostic value.

Gibson, on the other hand, has made the statement that a pressure appreciably below the normal in pneumonia is invariably of good omen, and that a considerable fall bodes disaster. "When the arterial pressure, expressed in millimeters does not fall below the pulse rate expressed in beats per minute, the fact may be taken as an excellent augury, while the converse is equally true." This is known as Gibson's rule, and his statement is confirmed by Gordon.

<sup>1</sup> Archives of Internal Medicine, July 15, 1914.

The authors cited studied 15 cases of lobar pneumonia, and as a rule the measurements were made in the middle of the morning and the middle of the afternoon, from entrance until death, or in the cases of recovery, until they were well into convalescence. The cases were unselected, except that all cases in which there was any doubt about the diagnosis were avoided, as were all persons showing any cardiovascular disease. They also studied the records of the Johns Hopkins Hospital, and they came to the conclusion that the blood pressure curve does not suggest the failure of the vasomotor centres in pneumonia, and also that low systolic pressure is not invariably to be taken as evidence of anything untoward happening. They found that the systolic pressure in fatal cases tended to be higher than it did in the patients who recovered.

It was their experience that prognosis based upon Gibson's rule was wrong more often than it was right, nor could they express any definite conclusions on the facts concerning the relations of pulse and pressure. They also came to the conclusion that in the treatment of pneumonia the blood pressure could not be taken as a basis for the administration of drugs.

**TREATMENT OF PNEUMONIA OUT OF BED.** There have been some remarkable changes in our ideas concerning the necessity of rest in bed, and this is particularly true in connection with the surgical and obstetrical wards. In many clinics, it is now the method to get patients out of bed as soon after a laparotomy as practical, and the same is true of delivery. One would hesitate, however, to use this method of procedure in the treatment of many diseases.

The experience of Widmer<sup>1</sup> is very remarkable. About ten years previously, he was called to treat eight men who, in putting out a fire in the village, contracted extremely severe pneumonia. The disease began with the usual chill, coming on from nine to thirteen days after their exposure to the fire, and this was immediately followed with mental disturbances, and delirium. This was particularly disturbing at night. As the patients lived long distances from each other, and it was not possible to look after all of them during the outbreaks of delirium, he tried having them dressed and permitting them to sit up out of bed. Widmer was very much surprised to find that, as an effect of this, the delirium disappeared, the fever became lower, and the pulmonary manifestations lessened, and quite to the contrary of what one might expect, none of them died. Owing to the happy outcome of this experience, he began using it in other cases, 39 men and 13 women. All these cases had more or less mental disturbance. Some were true pneumonia due to the pneumococcus, and some were cases of grippe. The series included one case of delirium tremens, in which the delirium began

<sup>1</sup> Münchener medizinische Wochenschrift, May 26, 1914.

with the onset of the fever. All of these cases recovered. In most of his cases the patient was taken out of bed on the second day, and remained up from four to six hours.

**Poliomyelitis.** A very large number of facts have been added to our knowledge of poliomyelitis since 1909, the year in which the first experimental transmission of the disease to lower animals was accomplished. The virus of the disease has been cultivated by Flexner and Noguchi, but the cultivation of it is attended with so many difficulties and such variations in virulence that, for all practical purposes, we may still regard the emulsion or filtrate prepared from the affected tissues as for experimental use. There seem to be variations in the virus, such as are met with in organisms causing other diseases, and this is well shown in the relation of the transmission of the disease from man to monkeys. The number of successful implantations has varied from one-half or less of the specimens tested to all those inoculated. In Sweden, there has been an epidemic of very marked virulence and this particular virus seems to have a special activity for monkeys; it has been possible to communicate the disease to these animals with filtrate washings of the nasal pharyngeal mucous membranes from acute cases. They have not, in Sweden, been able to transmit the disease to monkeys from healthy persons who are carriers, while this has been done by Flexner, Clark, and Frazer in the United States.

Flexner, Clark and Amoss<sup>1</sup> have contributed an article dealing with the epidemiology of the disease, their observations being upon a strain of virus which showed very definite variations in virulence. This strain has been propagated in monkeys for four years, and has passed through three distinct phases of virulence. These several phases cover different periods of time, but the onset of the virulence was low, infection was irregular, and recovery after paralysis not uncommon. After several passages through monkeys, a maximum virulence was obtained which was maintained for three years during which infection followed more regularly, and recovery occurred only rarely at first, and, later in the period, never occurred. Then, without known changes in external conditions, diminution in virulence set in and increased and this continued until the infective power became greatly diminished and resembled the virus when it was first obtained from the original human material. The changes in virulence are correlated with the wave-like fluctuations in epidemics of the disease which also consist of a rise to a maximum and then a fall in the number of cases. An explanation of epidemics of the disease is the inferred variations or mutations among the microorganisms and these changes apparently affect chiefly the quality of their virulence.

The same authors<sup>2</sup> have collected a certain amount of information

<sup>1</sup> Journal of Experimental Medicine, February, 1914, p. 195.

<sup>2</sup> Ibid., p. 205.

regarding the virus of the disease. They believe that it has a tendency to localize in the nervous system and is probably capable of multiplying in the extramedullary parenchymatous nervous organs. They have succeeded in demonstrating it by inoculation tests in the spinal, Gasserian, and abdominal sympathetic ganglia. All of these ganglia show histologic lesions more or less severe and similar to those of the spinal cord or brain. They conclude that the disease is a general disease of the nervous system, although the most prominent and important symptoms are those following injury to the motor neurones of the spinal cord and brain. The virus is highly resistant to glycerine, in which it survives for more than two years and to 0.5 per cent. phenol, in which it survives for more than one year. It dies out after having been kept frozen constantly for several months.

Amoss<sup>1</sup> has made a study of the virus with particular reference to the globoid bodies or minute microorganisms cultivated from the central nervous organs of human beings or monkeys that have died from poliomyelitis. He has found that these may be detected in the incubated brain tissues in forms which tend to show that they have multiplied after the death of the host. He found that in order to obtain cultures of the organism, poliomyelitic tissues should be incubated in kidney ascitic fluid culture medium and then crushed. The same bodies have been detected in blood films prepared on the twelfth day of the acute attack from a paralyzed, poliomyelitic monkey that had been inoculated intraspinaly, and he has also succeeded in cultivating this organism from the blood of a monkey that had received, intravenously, a large dose of the filtrate of the virus.

Clark, Frazer and Amoss<sup>2</sup> made a study of the blood in its relation to the virus of poliomyelitis and they have not been able to infect *Macacus rhesus* monkeys with human blood taken in the paralytic stage of the disease, nor have they been able to produce the disease from the blood taken from human beings that have died from the disease. They have, however, succeeded once out of ten tests in getting infection through specimens of blood removed at the beginning of the paralysis on the seventh day following an intracerebral inoculation into a monkey. They were not, however, able to produce the disease by taking the blood from one to forty-eight hours after the animal had been inoculated in the brain and spinal cord. If large volumes of the active filtrate are injected into the circulation, the blood remains infective for seventy-two hours at least, but later on, when the paralytic symptoms appear, it no longer has the capability of producing the disease. If small quantities of the filtrate are injected, or if the filtrate used is less active, the blood fails to convey the infection or only does so very irregularly.

<sup>1</sup> Journal of Experimental Medicine, February 1, 1914, p. 212.

<sup>2</sup> Ibid., March, 1914, p. 223.

It will be seen that only when overwhelming quantities of an active virus are injected into the blood does paralysis result. The injection of moderate doses is not followed by paralysis, although the virus may still be detected in a blood sample twenty-four hours after injection. It would seem that there is some mechanism capable of excluding the virus within the blood from the central nervous organs. Infection is accomplished with much more difficulty through the circulation than by means of lymphatic and nervous channels of communication with the central nervous system.

They have also made some interesting experiments with the stable fly, *Stomoxys calcitrans*. In 1912, Rosenau and Brews reported to the Fifteenth International Congress on Hygiene and Demography that they had, in several instances, succeeded in transmitting the disease by means of the stable fly, and this was confirmed by Anderson and Frost. Clark, Frazer and Amoss used Rosenau's method and very active virus. Their experiments need not be given in detail, but the virus was injected into a monkey, and, from the time the disease became very evident until the animal died, about 200 flies were permitted to feed on the monkeys for two or three hours daily. These flies were caught at stables in New York City, and the loss by death was made up by adding fresh flies from time to time, so that a total of about 400 flies were used. These same flies were allowed to feed upon another animal subsequently, so that they were fed at least ten times upon infected monkeys within fourteen days, five of the feedings having been taken twice before, and five after the onset of the paralysis. These flies were then allowed access for two or three hours at a time to four healthy monkeys, and this exposure covered a period of thirteen days, during which time they were exposed ten times. None of the monkeys developed the disease, and at the conclusion of the feeding the dead flies were collected, ground up and converted into a Berkefeld filtrate which was inoculated into the brain of a monkey, with a negative result. Two other experiments were made in somewhat the same way, and this would seem to be explained by the observations that have been made upon the blood as outlined above. It will be recalled that Anderson and Frost have made a second series of experiments which were negative, and that the very comprehensive experiments of Sawyer and Herns were also negative.

THE PENETRATION OF THE VIRUS OF POLIOMYELITIS FROM THE BLOOD INTO THE CEREBROSPINAL FLUID. Among the other studies that have been made upon this subject are the experimental observations of Flexner and Amoss.<sup>1</sup> With the active virus of poliomyelitis, it is an easy matter to infect monkeys by injecting it directly into the brain and subarachnoid spaces or the peripheral nerves. If one attempts to produce the disease by injecting the virus into the circulation, it has

<sup>1</sup> Journal of Experimental Medicine, 1914, vol. xix, p. 411.

been found that very much larger quantities are required, and that a much longer time elapses before the development of the symptoms, and the paralysis occurs later. Owing to the length of time it takes, and the size of the dose, it appears that the virus must reach the central nervous system by some indirect route. It has been pretty conclusively demonstrated that the virus of poliomyelitis enters the body in one of two ways, either through the blood, or by way of the upper respiratory tract. When placed upon the nasopharyngeal membranes, the virus may pass through the lymphatic channels to the olfactory nerves, and thence to the brain, or it is possible that it enters the brain and eventually reaches the central nervous system through the general circulation.

Flexner and Clark have shown that the virus, introduced into the upper nasal mucosa, can be followed from the olfactory lobes of the brain to the medulla oblongata, and the spinal cord. If the distribution of the virus had taken place through the general circulation, the various parts of the nervous system should be rendered infectious almost simultaneously.

The experiments seem to show that the virus introduced into the blood, penetrates to the choroid plexus, and this requires a certain amount of time. By the inoculation test, no virus was detected in the cerebrospinal fluid at the expiration of forty-eight hours, and only small amounts at the expiration of seventy-two hours, while at the expiration of ninety-six hours, the virus was passed more freely, and could still be detected nineteen days after the intravenous injection, at the time of the onset of the paralysis.

RELATION OF POLIOMYELITIS IN MAN TO PARALYTIC DISEASE IN ANIMALS. There have been many reports that have attempted to show the relationship of poliomyelitis in man to paralytic disease in animals. Pierson<sup>1</sup> reports a small epidemic occurring in some of the fishing villages in central Alaska, in which the epidemic among the human subjects was preceded by an epidemic of distemper among the dogs. The symptoms in the dogs were the same as those in the human beings. Pierson calls attention to several points of considerable interest. The epidemic took place away from the usual route of travel, and there is no history of any such epidemic before, and there were no domestic animals other than dogs. These dogs are subject to several diseases, one of which is particularly fatal and accompanied with partial motor paralysis. Epidemics of this occur every three or four years, although there are apt to be occasional cases between the epidemics. The young animals are affected, and, in epidemic years, practically all the animals which had not been previously infected are attacked. The disease in the dog commences with symptoms of coryza. The animals may die in two or three days or the disease may become more

<sup>1</sup> Journal of American Medical Association, February 28, 1914, p. 678.

chronic and the dog may live for several weeks, or ultimately recover. Some of the adults in close contact with these dogs had similar symptoms, beginning like an attack of influenza and ending up with paralysis. The study of this epidemic is incomplete as there was no opportunity to make a bacteriological and pathological study of the disease. This disease may have been something other than the ordinary poliomyelitis, but it certainly makes it the duty of health officials and others interested to pay more attention to the paralytic diseases of animals.

THE GREEN FLY EPIZOOTIC IN ITS RELATION TO POLIOMYELITIS. Saunders, Meisenbach and Wisdom<sup>1</sup> have contributed an article upon this subject in which they recount the occurrence of an epidemic disease affecting chickens and turkeys, pigs, dogs, and other domestic animals. In addition, badgers, sparrows and buzzards were affected, and, a little later, a horse. These animals were stricken rather suddenly, either dying overnight or becoming paralyzed. These animals were all on one farm and subsequently one of the eight children of the farmer was infected with infantile paralysis. The buzzards were affected after eating the carcasses of the other animals.

The observers started about eighteen months ago to search for a larval fly which, when ingested into fowls or other animals, would produce a rapidly fatal paralytic disease. That the condition was not one of ptomaine poisoning or due to ordinary maggots was proved by feeding fowls on putrid flesh, and later on putrid flesh in which there were numerous maggots. They found, eventually, that the larvæ of the green fly, *Lucilia caesar*, was capable of producing symptoms, but in order to do this the green fly had to become infected by feeding on the carcass or possibly the secretions of an animal affected by the green fly epizootic, or, as the authors state, on a case of poliomyelitis. The feeding must take place at least two days before the eggs are laid.

Attempts to inoculate fowls, guinea-pigs, or other animals, with the blood or tissues of animals dying after ingestion of the specific larvæ, failed. On the other hand, the carcasses of the animals that had died, usually within a few hours and sometimes several days, after the ingestion of the specific larvæ, never failed to infect green flies, so that their ova, deposited the third day after feeding, were virulent. The observers were able to kill a young fowl or guinea-pig of any age, sometimes within six hours by the oral administration of a single specific larva. Monkeys are also easily infected, surviving from twenty-four hours to six days after the first dose, according to the amount ingested and the virulence of the larvæ. The monkeys, however, showed symptoms somewhat different from other animals in that they developed a profuse coryza, a moderate temperature, and paralysis of various groups of muscles.

<sup>1</sup> Journal of Missouri State Medical Association, March, 1914, p. 305.

The pathological changes in the animals dead from this disease were similar to poliomyelitis.

This rather remarkable report should lead to further experiments by other observers to substantiate or disprove the claims made by the authors. Their proof of the association of this disease with poliomyelitis in the human being would not seem to be very well founded. It is very probable that there are a larger number of poisonous substances which will produce changes in the central nervous system more or less similar to those found in poliomyelitis. Up until the past few years this subject has not been studied, but recently large numbers of paralytic disease in animals have been noted, and it remains for future observers to make studies of these to determine their exact nature.

**POLIOMYELITIS AND THE LYPERSIA IRRITANS.** Francis<sup>1</sup> has given the details of attempts to transmit poliomyelitis by means of bites of the blood-sucking fly (*Lyperosia irritans*), to the *Macacus rhesus* monkey. Eight different monkeys were used, and the greatest care was taken with the experiments. Repeated exposures were made. The results were all negative.

**TREATMENT OF PARALYSIS OF POLIOMYELITIS.** There has been a tendency to regard the paralysis following acute poliomyelitis as a thing to be let alone, or to be treated only by surgical measures. Massage and exercise have been recommended, and only too frequently neglected or carried out in an inefficient manner. It is therefore interesting to note the results obtained by Frauenthal.<sup>2</sup> The treatment that he recommends consists of electricity, massage, hydrotherapeutics and muscle education in which there is a mental concentration to guide the muscle effort. In regard to the use of *electricity*, Frauenthal differs with most authorities, and advises the use of it early, even before the temperature is normal. It has generally been assumed that the early use of electricity was not advisable and that the period of from four to six weeks should elapse before beginning it. He has used the Oudin, or high-frequency current, along the spinal column during the first few days of paralysis to reduce the blood and serum compression on the nerve-cells in the spinal cord and he believes that this result has been obtained, and that recovery has been hastened in consequence. Whether this is so, is exceedingly difficult to prove. The muscles involved are treated with a sinusoidal current, alternating with a combined galvanic and faradic current. Contraction of the affected muscles can be obtained by this means when they can not be contracted by voluntary effort and this is used to keep the muscles in a good state of nutrition. The electrodes are applied as near as possible to the origin and insertion of the muscle or muscle groups. The strength of the current should be the weakest that can produce a contraction, and

<sup>1</sup> Journal of Infectious Diseases, July, 1914, p. 1.

<sup>2</sup> Journal of American Medical Association, December 20, 1913, p. 2219.

should never be continued after the muscle ceases to contract, nor longer than from two to three minutes on any particular muscle group, or from six to twelve minutes on the body at one time. The over-treatment with electricity is much worse than not using it at all. The fact that over-dosage with electricity is dangerous and that there is always danger when it is used in the home, lead one to be exceedingly cautious unless the electric treatment is given in a hospital or under trained supervision. In general practice, it is not always possible to secure this.

*Massage* may be given as soon as the acute inflammatory symptoms have disappeared and should be continued daily for weeks or months, even when it is apparently not producing any results. The effect of massage in these cases is very remarkable. The fact that it is not carried out systematically and over long enough periods, has led the nerve authorities to regard it as ineffectual. In the same way as electricity, massage is capable of doing harm. A daily treatment should not last more than twenty minutes. The affected member may also receive a certain amount of help through *hydrotherapy*, and one of the best methods is to immerse the affected member in hot water, 95° F. for twenty minutes.

The last part of the treatment consists in *muscle education*. This is best done before a mirror, the patient trying to move the muscle and, when this cannot be done voluntarily, having the person superintending the treatment make the necessary motion. This is difficult in young children, but can be tried in all children over three years of age. This should not be continued but for a short time at one sitting. In the correction of deformities, one should be particularly careful to secure the continuance of the development of the weak muscles and to avoid exercising the healthy muscles by improperly used exercises. The healthy muscles may be developed very much more rapidly than the deformed ones, thus resulting in worse deformity than when the treatment was started. It is therefore necessary to explain to the one directing the treatment just what should be done and not to deviate from the directions given.

**Rabies.** THE USE OF QUININE IN RABIES. Last year I noted the experiments of Moon which consisted in administering quinine sulphate to dogs with rabies and their subsequent recovery; also the observation of Harris on a case of rabies in man ending in recovery after the intravenous administration of quinine and urea hydrochloride. Williams<sup>1</sup> reports a case of rabies unsuccessfully treated with quinine. The patient was a boy, aged four years, who was bitten on November 2, 1913. The wound was a deep laceration across the middle of the nose and a deep puncture above the lip. Two hours after the bite it was

<sup>1</sup> Public Health Reports, April 17, 1914

painted with iodine, and healed rapidly. The dog had shown signs of the disease while playing with the child. It was shot the same evening, and the brain examined at the Bureau of Animal Industry, where it was found to contain negri bodies. The child was taken to the Hygienic Laboratory and antirabic treatment immediately begun. On November 23, the last day of the treatment, the parents stated that the child had been fretful during the preceding night and had vomited once or twice. The following evening the patient became very restless and this increased until the next morning, when he had developed typical rabies. The child was anesthetized at noon and 4 grains of quinine and urea hydrochloride dissolved in 2 cubic centimeters of salt solution were injected into the cervical veins. At 2 P.M. he was given an intramuscular injection of 4 grains but the patient died within the next hour.

In addition to this case, Cummings<sup>1</sup> reports the following experiment: He found that full grown rabbits would tolerate about 1 grain of quinine as a daily dose, and guinea-pigs about 0.5 grain. Larger doses repeated daily were usually fatal, and sometimes, even the doses mentioned, when repeated, caused death. Having thus determined the effect of quinine upon these animals, the question of quinine treatment was taken up, and experiments carried out not only with fixed virus but also with street virus. A dose of virus used in most of the tests was not much larger than the smallest infecting dose. It was found that the quinine failed as a preventive measure against extremely small doses of virus, and, if this is true, one cannot reasonably expect to have the disease cured after its development, because then the quantity of virus present would be very large.

Cummings<sup>2</sup> has contributed a paper upon this subject dealing with the ACTION OF DISINFECTANTS, and various other factors, upon the virus and also a comparison of results of immunity tests on animals vaccinated by the various methods of antirabic treatment, including those of Pasteur, Högyes, and a method original with the author, which he calls the method of dialysis.

The author's paper is marred by the constant repetition of the abbreviation "M.L.D." for minimum lethal dose. Abbreviations of technical terms in scientific articles are exceedingly objectionable, unless they are explained at the outset, as most of the readers are unfamiliar with the jargon of the laboratory, and for workers in foreign languages, they are sometimes an insuperable obstacle.

The studies upon the virus determine the fact that 1 per cent. of phenol does not destroy the virus during an exposure of six hours, while a 2 per cent. solution killed it in less than twenty-four hours. A 2 per cent. solution of sodium chloride has an effect similar to a phenol solution of the same strength, in that it destroys the virus in less than two days.

<sup>1</sup> *Journal of Infectious Diseases*, July, 1914, p. 205.

<sup>2</sup> *Ibid.*, January, 1914, p. 33.

The destructive effect is apparently due to the non-isotonic condition rather than to any disinfectant action. Formaldehyde, however, acts as a disinfectant, killing the virus in less than two hours, in as dilute a solution as 0.08 per cent. As a result of this work, it is suggested that as a prophylactic method, the disinfection with formalin follow all wounds made by animals suspected of being rabid.

The effect of heat was found to be somewhat variable, but the result of the work may be summed up in a statement that the virus is destroyed in twenty minutes at a pressure of 45° C., in fifteen minutes by 50° C., in five minutes at 60° C., and in two minutes at 100° C.

The mortality from inoculation depends largely upon the avenue of injection. In rabbits, for example, a single injection into the vein of the ear rarely causes death, although if these injections are repeated on three successive days, the animal will generally die within four weeks. Injected into the peritoneal cavity, injections of the same strength give a mortality of 15 per cent., and when the intramuscular or subcutaneous route is chosen, the mortality is about 50 per cent. Each injection made under the dura is fatal. Cummings also noted that injections made with large needles with roughened surfaces more often resulted fatally than injections made with a small, smooth needle. It was also noted that repeated injections are almost always fatal, even though made by a route which is ordinarily attended by a low mortality. The infection is supposed to depend upon the laceration and entrance into the nerve trunks of the virus. Where the virus is so placed that it can enter these readily, opportunity for the virus to reproduce itself seems to be found. If the virus does not come into direct contact with broken nerve fibers, it will probably be destroyed by the action of the blood and lymph. As long as it is limited to the peripheral nerves, it apparently cannot reproduce itself in sufficient quantity to cause symptoms of the disease, but, when the spinal cord or brain is reached, the development is sufficient to produce characteristic symptoms and death. For this reason, even after a number of days, Cummings advises that the wound be reopened, thoroughly scraped, and cauterized with formalin or with fuming nitric acid.

He also found that if the virus was placed in collodion sacs and these placed in the peritoneal cavity of either rabbits or guinea-pigs, it lost its virulence in from three to six hours. A comparison of the virus attenuated by this method with the original method of Pasteur shows that in animals the immunity given is somewhat less in the former.

These experiments led to the attenuation of virus by the destructive effect of running distilled water. For preparing this virus, a homogeneous suspension of rabid brain is used with standardized collodion sacs. By using injections of this virus, it is possible to immunize animals against as much as eight times the minimum lethal dose. This virus has the advantage of not producing the disease, even when injected

intracranially. The author urges that this method of attenuation is superior to methods suggested by Pasteur and Högyes.

In the Pasteur method, the virus is dried for a number of days, and the treatment is begun with cord that is dried from thirteen to fourteen days, and the strength is increased at each injection so that by the eighth day, a cord which is dried four days is used.

It is possible to reproduce rabies in animals by the intracranial injection of suspension made from cord that is dried for six days. The Högyes method consists of using dilutions of virus. Any of these will produce the disease when injected intracranially into animals. The danger of producing the disease in man, however, by the use of these injections has been shown to be absent. They have been in use too long, and in too large a series of cases, and have been studied too critically for one to believe that any danger attends their use. Cummings' method, however, gives a rapid immunity, inasmuch as twelve successive daily injections of standardized dialyzed vaccine produces the same effect in animals as is obtained by the intensive form of the Pasteur method which consists of twenty-one daily injections.

Of 800 persons, bitten by animals suspected of having rabies, who have been treated by this method at the Pasteur Institute at the University of Michigan, and elsewhere, 62 per cent. were bitten by animals known to be rabid. In this series the treatment has been efficient in protecting the patients against hydrophobia in every case.

The treatment consists of the injection of 2 c.c. daily for from fifteen to twenty-five days. It was not uncommon to see the local anaphylactic reaction at the site of the injection, which comes on ordinarily about the seventh or eighth day, and is manifested by redness and slight swelling. This reaction is not very marked and does not last much over twenty-four hours. In cases in which there was a possibility of the saliva from a rabid animal having entered an open wound, fifteen days was the length of treatment. The other cases were treated somewhat longer, and in cases of severe uncauterized bites on uncovered surfaces of the body, especially on the face, and in which there had been a delay of two weeks or more in applying the treatment, two injections were given daily, for the first four days, and then a single daily injection through the twenty-fifth day. The series of cases so treated is too small to admit of an accurate comparison between this method and that of Pasteur and Högyes. Up to date, however, better results could not be obtained, as it shows 100 per cent. of preventions. This, if it continues, will be better than the statistics obtained by the other methods, the best statistics giving all classes of cases showing at least a mortality of 0.25 per cent.

**PATHOLOGY OF RABIES.** Monouelian<sup>1</sup> has been able to demonstrate the existence of the negri bodies in the nervous ganglion of the salivary

<sup>1</sup> *Annales de l'Institut Pasteur*, March, 1914, p. 23.

glands. He has examined the submaxillary and the parotid glands in a large number of animals, and especially dogs caught in the streets. He has not been able to demonstrate any of the bodies in the glandular substance itself, either in the cells or in the ducts. In making examinations there is one source of error possible which he warns against particularly, namely, the possible confusion of the negri bodies with the debris of leukocytes or of the gland cells. In dogs with street rabies there is a considerable invasion of the acini and ducts of the glands with polynuclear leukocytes. These cells are rapidly destroyed and fragments of the nucleus present granulations which might easily be mistaken for a negri body. This debris is taken up by the macrophagic cells until finally the portions of the glands affected are chiefly a mass of these cells.

**Rheumatism.** THE ETIOLOGY OF ACUTE RHEUMATISM. There have been a great many studies made upon the etiology of acute rheumatism, both of the articular and muscular type. Poynton and Paine, in 1900, described a streptococcus which they believed to be specific, but subsequent observers have not been able to obtain these microorganisms from the joints, or have succeeded only occasionally.

Rosenow<sup>1</sup> has reported the results of cultures from the blood and local lesions in cases of articular and muscular rheumatism. The cultures were made from the joints by sterilizing the skin with tincture of iodine, and aspirating with a syringe, using a needle of small calibre. The cultures were made under aërobic and anaërobic conditions in various kinds of media. It was found that the organism was very sensitive to oxygen pressure, and this was suggested by the fact that the lesions in rheumatism occur in relatively avascular regions. To obtain entirely suitable conditions, the fluid was inoculated into tubes containing diluted ascites—dextrose agar, the tops of which would give aërobic conditions, while the bottoms would be anaërobic, on account of the oxygen-consuming properties of the leukocytes in the exudate. The space between these will represent a gradual transition from one to the other. It was found that the colonies never developed above 0.5 cm. from the top, and never below 2 cm. from the bottom of the tubes. The largest number of colonies developed between 1.5 cm. from the top and 5.3 cm. from the bottom. Blood cultures were also made.

A study of all the cases shows that three types of organisms have been isolated from the joints, each of which can be converted into the other very readily. In cases in which no muscle involvement was present, two types were isolated, one resembling a micrococcus, the other forming long chains. If injected into animals as isolated, both of these produce arthritis, endocarditis, and pericarditis, but not usually

<sup>1</sup> Journal of Infectious Diseases, 1914, p. 61

myocarditis, and never a myositis. The third type, a diplococcus, having a tendency to form short chains, was found in cases of rheumatism in which there were definite muscular involvements. When injected, as isolated, into animals, these produce arthritis, endocarditis, pericarditis, and they differ from the others in that they also cause a clinical myocarditis and myositis. All three forms have a very low grade of virulence and are susceptible to the action of phagocytes. They suggest the term *Streptococcus rheumaticus* for the present, not because the organism will always produce rheumatism, but because when it does, it has special features which streptococci from other sources do not usually have. The affinity for the joints, endocardium, pericardium, and sometimes for the myocardium which is present in organisms taken directly from the body tends to disappear on cultivation but it may be restored by passing through animals, and it has also been found that other strains of streptococci under certain conditions may be made to acquire the features of strains from rheumatism. When the strains have acquired the features of hemolytic streptococci, they lose their affinity for the endocardium and pericardium, and show a greater tendency to attack the joints. When they are converted into types resembling pneumococci, the intravenous injection of them causes pulmonary hemorrhage and pneumonia, and, if the virulence is increased, death may result from pneumococcemia.

Rosenow suggests that it is possible that, before an attack of rheumatism certain of the streptococci group acquire, in the tissues of infected individuals, characteristics which cause them to have an affinity for the joints, endocardium, pericardium, and myocardium. When these organisms, and also other streptococci, are grown in symbiosis with other bacteria, where there is low oxygen pressure, other characteristics may be developed, and on passing through animals these may undergo marked mutations. In the human body, such conditions may be found in the tonsils, teeth, about the gums, in the various sinuses, and in the appendix. These experiments may explain acute attacks of rheumatism following mild attacks of tonsillitis. It is important to bear in mind the possibility of microorganisms taking on new features due to the environment at the site of the entrance into the body.

Rosenow also suggests that from experimental evidence it seems very possible that the lesions in the iris are produced by the lodgement of organisms in the fine capillaries, and the occurrence of lesions in the appendix and of colitis in animals which receive intravenous injections, suggest the possibility of organisms entering through the lymph structures of the intestinal tract. He also found that the strains from muscular rheumatism, especially after being passed once or twice through animals acquire a marked affinity for the mucous membrane of the stomach, gall-bladder, and the pelvic mucous membrane, also the medullary portion of the kidneys. This is also true of other streptococci

which attain a lower grade of virulence, and result, in animals experimented upon, in ulcers of the stomach, nephritis, and cholecystitis with the formation of gall-stones.

**HYPODERMATIC AND INTRAVENOUS INJECTIONS OF SALICYLATES IN RHEUMATISM.** In 1911, Siebert<sup>1</sup> published a method of using sodium salicylate in rheumatism, and he mentioned the method of Mendel of injecting this drug intravenously. The drug had also been used by Bouchard, by injection about the affected joints in a 30 per cent. solution. Bouchard's method never came into general use, nor has there been any extensive practice of the methods suggested by Mendel or by Siebert. Siebert used injections of cocaine to lessen the pain, and followed this by a 15 per cent. solution, injecting at a dose 10 cubic centimeters for every 100 pounds of body weight every twenty-four hours. Various numbers of injections were given, from 4 to 6, for example, being used in chorea.

Mendel's method was published in 1904, and his conclusions are reached after using some three hundred injections. The method seems to be reasonably free from dangers and objections, but thrombosis of the vein at the site of the puncture occasionally occurs. Mendel treated all sorts of rheumatism, including acute joint affections, muscle affections, and also cases which involved the serous membranes. Various other observers, including Baehr, Rubens, and Brugsch reported upon this method, the first two claiming remarkable analgesic results, the last named stating that this method had no advantage over the ordinary method of administration.

Conner<sup>2</sup> has used this method in 12 cases of articular rheumatism. As many as one hundred and thirty injections were used. He found that, to obtain satisfactory results, larger doses than had been advocated by Mendel were necessary. The solution suggested by Mendel consisted of a mixture of sodium salicylate, and caffeine sodio-salicylate. He injected 2 cubic centimeters, which contained about 8 grains of sodium salicylate, and 1 grain of caffeine, at intervals of twelve hours, usually giving from two to four injections. Mendel insisted that, in order to avoid danger, it was necessary to inject this into a large vein, and that the vein should be well dilated by letting the arm hang down for several minutes with the fist tightly closed, and an elastic ligature around the arm to prevent the venous outflow. As far as possible, a fresh vein is selected for each injection. Conner used a 20 per cent. solution of sodium salicylate, and he found that by using very fine, sharp-pointed needles, thrombosis could be avoided. The solution changes on exposure to light, and takes on a reddish or brownish tinge, and, if the solution is not perfectly fresh, the injection may be followed by a chill. The chemically pure salicylate gives a clear solution, which,

<sup>1</sup> Medical Record, March 11, 1911.

<sup>2</sup> Ibid., February 21, 1914

if protected from light and air, will keep for several days. He used a stock solution made by dissolving 10 grams of chemically pure crystalline sodium salicylate in 50 cubic centimeters of distilled water, which had been freshly sterilized by boiling. The drug is weighed and handled as antiseptically as possible, and, after being made, the solution is not sterilized. He used 15 or 20 grams at intervals of from eight to twelve hours over a period of from three to six days. In unusually robust men, as much as 30 grams have been given at one dose without any untoward effect.

Conner is not at all convinced that this method is very much better than the ordinary method of administration, but he thinks that in certain cases it has a distinct field of usefulness, and may be tried in those patients who are unable to retain the drug when given by mouth, and also in those cases who do not respond to the drug when given by the usual method, and in cases in which the pain is unusually severe. It may be useful also in cases in which there is beginning heart involvement, when the rapidity of its action would seem to be a distinct advantage. Its usage has been studied by Sauton.<sup>1</sup>

THE INTRARECTAL ADMINISTRATION OF SODIUM SALICYLATE IN ACUTE RHEUMATISM. This method of treatment was suggested by Erlanger in *Deutsche Archiv für Klinische Medizin* in 1893. He reported 25 cases which show satisfactory results with doses averaging from 6 to 8 grams daily, and his experiments show that the drug was readily absorbed from the rectum. Inasmuch as sodium salicylate so frequently causes nausea, it is strange that this method has not received more attention.

Heyn, in 1912, reported 22 cases, and in 1914,<sup>2</sup> he published 100 additional cases, both from hospital and private practice. Heyn gives six advantages of this method:

1. The ease of administration.
2. The complete absorption of the drug.
3. A minimum of untoward effects.
4. Possibility of administering large quantities, as is desirable in bactericidal therapy.
5. The removal of the residue of the drug from the bowel by subsequent enema if the dosage has been proved excessive.
6. The prompt results, more so than in any other method.

The method of administration consists of giving a cleansing soap-suds enema, and following this by an injection of the drug, given by means of a Davidson syringe, the tube of which should be inserted six or eight inches. The initial dose in women was from 6 to 8 grams, and in men from 8 to 11 grams. Heyn used synthetic salicylate in all of his cases. The drug was given in from 120 to 180 c.c. of plain, or starch-water,

<sup>1</sup> Paris Thesis, 1906, No. 192.

<sup>2</sup> Journal of American Medical Association.

with the addition of from 1 to 1.05 gram of tincture of opium. This may be repeated in twelve hours, and it can then generally be determined whether or not the symptoms of salicylate intolerance will appear.

In most cases, a daily enema with the dose increasing from 30 to 50 per cent. daily, until the limit is reached, is found to be satisfactory. The largest daily dose that has been given was 24 grams and the only symptoms of any moment of the drug that have appeared have been tinnitus aurium and excessive perspiration. In one or two cases there has been vomiting. If the symptoms of overdose appear within from three to six hours and are very marked, the residue of the salicylate may be removed by enema. The drug is absorbed with remarkable promptness, usually within fifteen minutes, and always within thirty minutes, and the ferric chloride reaction is seen in the urine, as a rule for from twenty-four to thirty-six hours, depending on the size of the dose. There is generally complete absorption of the dose from the rectum, and apparently most of the salicylate is absorbed within twelve hours.

**Rocky Mountain Spotted Fever.** Fricks<sup>1</sup> has made a short note of the investigations made of this disease by McClintic. His studies were made in the Bitter Root Valley, Montana, and, at the end of the season's work, McClintic contracted the disease and died at Washington, D. C. McClintic collected almost two thousand ticks in different localities and these were placed in groups on susceptible guinea-pigs and allowed to feed until completely engorged, whenever they would do so. Of these, 1282 were known to have fed a sufficient length of time to infect their hosts. These ticks came from fourteen different localities, six of which were found to be infected with the virus of the disease. Some of the ticks were collected from mountain goats but there is no evidence to support the belief that the mountain goat can acquire or transmit the Rocky Mountain spotted fever. In the course of his studies, he found a number of ground squirrels (*Citellus columbianus*) that were entirely immune and which, is presumed, had acquired this immunity by having previously had this disease. It was found that the ground squirrel from the localities in which the spotted fever virus was found, showed a higher percentage of immunity than those from the localities in which there was little or no spotted fever. He also repeated the experiments of Ricketts on woodchucks (*Marmota flaviventer*) and found that they were susceptible both by inoculation and through the bites of infected ticks.

**Rubella.** There have been few or no experimental observations made in German measles, so that an article by Hess<sup>2</sup> is of particular interest. He had occasion to study an epidemic in an infant asylum, and it was found that there were no organisms in the blood, so far as

<sup>1</sup> Public Health Reports, April 24, 1914.

<sup>2</sup> Archives of Internal Medicine, June, 1914, p. 913.

could be determined by the bacteriologic methods in use at the present time. This research included the most recent forms of culture, including those suggested by Noguchi. An attempt was made to reproduce the disease in monkeys, four *Macacus rhesus* being inoculated with blood from four different cases. The results were negative, with the exception of one monkey who had a rise of temperature eighteen days after the inoculation. As the temperature of monkeys is somewhat unstable, no particular significance can be attached to this rise.

The investigation of the blood, with reference to changes in the leukocytes, included 7 cases. In 1906, Hildebrandt and Thomas found a leukopenia at the outset of the exanthem, and an increase of lymphocytes as well as an increase in the large Türk cells. Two years later, Michaels studied 80 cases and found, in most of them, a leukopenia. In the cases studied by Hess, there was in most instances a definite increase in the lymphocytes, often preceding the exanthem. This fact may be of value in epidemics in institutions, for the purpose of facilitating segregation of infected children, and it may at times be used in differentiating German measles from scarlet fever. If a leukocytosis is found affecting the polynuclears, the evidence would be suggestive of scarlet fever, while a lymphocytosis would be in favor of rubella.

**Scarlet Fever.** THE PATHOLOGY OF SCARLET FEVER. Most of the work which has been done upon this subject shows that the streptococcus, which is usually present, is to be regarded as a secondary infection or as an associated organism. It is true that the streptococcus causes a large number of changes in the tissues, and is probably many times responsible for toxemia and death. There does not seem to be any question, however, that there is another organism which is to be regarded as the primary cause of the disease.

From time to time, a rather large diplococcus has been demonstrated in the cultures and smears from the throats of scarlet fever patients, and Class, some years ago, thought that he had succeeded in transmitting scarlet fever to pigs by means of this organism. This work was not confirmed by other observers. Those who have worked with this organism regard it as highly polymorphous, which may account for the difference in descriptions.

Ferry<sup>1</sup> has recently isolated a large coccus, usually found in pairs, which differs in some of its reactions from some of the organisms which have been previously described. Inoculation experiments upon monkeys were not conclusive, but, owing to the large number of organisms present in the scarlet fever patients, a certain amount of experimentation<sup>2</sup> was carried on with a vaccine prepared with it. These experiments were carried on in association with Kiefer, and the new organisms which

<sup>1</sup> Medical Record, May 23, 1914, vol. lxxxv, p. 9344.

<sup>2</sup> *Ibid.*, p. 936.

are tentatively called the Micrococci "S" were used alone, and also combined with streptococcus vaccine. Comparison was made with untreated cases, and also cases treated with streptococcus alone. The difference in the results was trifling and, from a practical standpoint, they may be regarded as negative. The collected cases, which are too few to draw any conclusions, showed fewer complications and no deaths.

The following is the table of their results:

Cases.	Untreated 318 per cent.	Mic. "S" 44 per cent.	Streptococcus 29 per cent.	Combined 33 per cent.
Uncomplicated . . .	80.19	77.25	86.2	84.84
Complicated . . .	19.81	22.72	13.8	15.15
Adenitis . . . . .	8.1	22	6.8	12
Otitis media . . . .	6.6	9	13.7	12
Deaths . . . . .	4.4	4.45	0	0

Certain prophylactic tests were also made. The authors state that up to the time of starting the prophylactic injections, six nurses, out of about one hundred, had contracted the disease. During a period in which the vaccine was used, among the nurses who had not had the disease, not a case has been reported during a period of three months. When the prophylactic injections were discontinued, four out of about twenty became infected. They do not state, however, the number of nurses upon whom the prophylactic injections were used with apparent success.

The authors suggest that the apparently favorable results may be a coincidence, but they also believe that this organism should be followed up to determine its true status. Everyone will agree with them that while it is extremely probable that there is nothing in this, it will be a relief to have this entire group of organisms, so many times studied, got out of the way for future investigators.

**ANAEROBIC CULTURES IN SCARLET FEVER.** The search for the organisms causing and associated with scarlet fever by the newer methods of blood culture have been commented upon by Dick and Henry.<sup>1</sup> They made a study of 24 cases, and in only 4 of their cases were the cultures negative. When it was found that positive cultures could be obtained by the methods used, cultures were also made from the throat and urine, and from material obtained at two autopsies, using tissue from the lymph nodes, spleen, and kidneys. The methods employed were those which have been commented upon at various times, and which are noted above in the article dealing with the newer methods of bacteriological research, by Rosenow.

A comparison of the organisms found in the blood culture with the organisms present in the throat and urine seem to indicate that during the acute stage of the disease the bacteria enter the blood stream in

<sup>1</sup> Journal of Infectious Diseases, July, 1914, p. 84.

considerable number and are excreted in part, at least, in a viable condition through the kidneys. It is possible that the development of scarlatinal glomerulitis may be caused by the excretion of living bacteria through the kidneys.

The organisms which were found have been noted as commonly associated in scarlet fever. Some of these produce rashes in guinea-pigs, but it is not known whether any of the animals really had scarlet fever or not. Nine different groups of organisms were recovered from the blood. They include a small pleomorphic, Gram-negative bacillus very difficult to distinguish from a coccus. These were found to vary in their pathogenic effect, but, as a rule, were fatal to guinea-pigs in very small quantities. In addition, there were found pigment-forming organisms; long thread-like organisms; spore from a bacillus somewhat like the *Bacillus subtilis*; hemolytic streptococci; in 5 cases very small streptococci; two types of diplococcus, one Gram-negative, and the other Gram-positive; and, lastly, a diphtheroid bacillus was found in one case.

**SCARLET FEVER IN OLD PEOPLE.** Scarlet fever occasionally occurs in the aged, but is probably much more rare than is supposed. Ker,<sup>1</sup> in the experience of over 20,000 scarlet fever patients, with a single exception, never saw the disease in a patient over seventy. Caiger in 166,840 treated at the Metropolitan Asylums Board Hospital, during a period from 1892 to 1904, reports only 11 cases in individuals over sixty years of age. Brownlee, in 22,033, found only 2 between the ages of sixty and seventy. Pearson, in 14,654 cases treated at the Leeds Fever Hospital, found 5 between the ages of fifty and sixty years, but not a single case over sixty years of age. There is one case reported in the Glasgow Hospital Reports in which the disease occurred in a man eighty-five years of age. Ker's patient was a man of seventy-four who was admitted to the Edinburgh City Hospital as a suspected case of scarlet fever. He had been taken four days before with general malaise, rapidly followed by vomiting and chills. He had a marked form of scarlatinaform eruption with marked redness of the throat, rise in temperature and irregular pulse, 96 to a minute; the respiration was 24. The patient was admitted to the scarlet fever ward but before this he was examined with a view of finding some other cause for the eruption, but there was none. The course of the disease confirmed the original diagnosis of scarlet fever, the characteristic changes of the tongue, typical desquamation, and otitis and arthritis complicating.

**ABORTIVE SCARLET FEVER.** Some interesting observations have been made by Jochmann<sup>2</sup> on the subject of scarlet fever as it occurs in the infant during the first few months of life. His observations were made

<sup>1</sup> Edinburgh Medical Journal, December, 1913.

<sup>2</sup> Beiträge zur Klinik der Infektionskrankheiten und zur Immunitätsforschung, 1914, vol. ii, p. 2.

in 10 cases at the Rudolf Virchow Hospital in Berlin. One of these cases occurred during the ninth month; all the others were in children under three months of age, and, with the exception of the child of nine months of age, were the children of mothers infected with scarlet fever. The onset in the 9 cases was from the third to the seventh day after the disease was noted in the mother. It began with fever which persisted from two to four days, and in many of the cases there were typical changes in the tongue and redness of the tonsils and the palate. There were, however, no necroses nor exudate in the pharynx, but the children were not able to swallow normally, which led to the examination of the throat. In 2 cases, there was a scarlatiniform eruption, and in the other cases, there was only a slight desquamation, appearing rather late. In some cases, there was a transient albuminuria. With the slight manifestations of the disease, diagnosis could not have been made were it not for the presence of scarlet fever in the mother. Levi believes that he was dealing with an abortive scarlet fever, which up to the present time has escaped attention.

He is also of the opinion that children in early life are not immune to scarlet fever, as has hitherto been believed, but are capable of developing the disease, and in the cases in which they nurse mothers with the disease have it in a very much milder form than is usual.

**THE ISOLATION OF SCARLET FEVER.** The question of the isolation of scarlet fever in special hospitals has received a considerable amount of attention of late years, and among the contributions on the subject is one by Ker.<sup>1</sup> Taking the traditions that have come down to us, the normal minimum isolation recommended for this disease is six weeks, which may be taken as about the average period advised in most countries. Ker believes that this period may either be too short or too long, according to circumstances. This period is probably based on the length of time which it takes to secure complete desquamation and if the desquamated skin is not the source of the infection, and I think that one may state with certainty that late in the disease it is not, some other basis should be taken for determining the length of time isolation is maintained. The desquamated scales, of course, may act just as any fomites might and the patient's skin may be infected just as his clothes or any other object which comes in contact with him, but, as soon as the patient ceases to be infectious, the skin may be cleansed, so that there is no longer any danger. It will be remembered that Priestley, during an outbreak of smallpox, discharged 120 desquamating scarlet fever patients from the Leceister Fever Hospital without causing a single secondary case.

The germ of the disease, whatever it may be, seems to linger longest in the nose and throat, under certain conditions, and also in the dis-

<sup>1</sup> *Edinburgh Medical Journal*, January, 1914, p. 6.

charges from the ears, possibly from other suppurating surfaces. It seems that most of the cases are more liable to spread the disease during the first two weeks, and that after four weeks, apart from the discharge from the ear or manifest disease of the nose or throat, or the presence of suppurating surfaces, there is little danger of the spread of the disease. Ker suggests that the period of six weeks be reduced to five, and, as far as contact is concerned, a period of six days. He himself in hospital outbreaks is content with five days, and for schools he considers that seven days might be ample. McCollom, and certain other French and German writers, believe that the period of incubation is much longer.

**THE MILNE METHOD OF TREATING SCARLET FEVER.** Robertson<sup>1</sup> believes that many cases of scarlet fever may be treated at home with perfect safety, if what is known as the Milne treatment is used. This consists of applying carbolic acid, in the strength of 1 to 10, to the fauces, and carefully anointing the external surfaces of the body with eucalyptus oil. So much has been claimed for the Milne treatment that Robertson determined to investigate the effects, realizing that many had dismissed it with scorn without any investigation. Milne believes that the treatment should be used in the hospitals to reduce complications, to shorten the length of residence in the hospital and to reduce the number of return cases. Robertson's experience in the hospital was such that he did not believe the treatment was necessary, as results were no better than with the measures ordinarily employed, but, in the treatment of cases in private homes, he believes that it is worthy of a trial. In 100 cases treated at home by this method, there was but one second case and that occurred three weeks after the notification of the first. In 100 consecutive cases treated without the inunction method, there were 7 second cases. This experiment was made in Leith, the average number of inmates in the Milne houses was 7, in the others it was 6, and it showed up better than in the cases not so treated.

A report of 128 cases has been made by Schultze and Goldberger.<sup>2</sup> The authors report that they found the 10 per cent. solution of carbolic acid caused a number of their patients to pass smoky urine. This cleared up on stopping the carbolic acid, and, subsequently, in place of the 10 per cent. solution they used a 5 per cent. solution without any untoward effect.

Unfortunately, for the purpose of determining the exact value of the Milne treatment, vaccines were used in some of the cases. This vaccine consisted of *Micrococcus* "S," either alone or combined with a streptococcus. *Micrococcus* "S" was discovered a few years ago and consists of a large coccus found in the throat of scarlet fever cases, many times in pure culture and at other times out-numbering all other bacteria

<sup>1</sup> *Edinburgh Medical Journal*, March, 1914, p. 214.

<sup>2</sup> *Medical Record*, May 23, 1914.

excepting a streptococcus. They believe that the Micrococcus "S" is a factor in the production of scarlet fever. The results of the cases so treated were very satisfactory, in many cases terminating much sooner, and the temperature falling by crisis and not gradually as is usually the case. There were very few secondary contact cases and very few complications considering the fact that many of the cases occurred in families of extreme poverty and ignorance.

In the 128 cases there were two deaths (1.5 per cent.).

In view of the favorable reports made for this method of treatment, it would seem wise for some of the larger city health departments to practice it in their out-patient departments where the isolation cannot be otherwise carried out. If it has any value, it should be ascertained and the method introduced more generally. If it has no value, this should be determined and the method dropped.

RELAPSES IN SCARLET FEVER. Jacobson<sup>1</sup> has had an opportunity to observe an instance, which he believes to be unique, in which there was relapse in scarlet fever in four children of the same family. As early as the work of Thomas in 1869 and 1874, the relapses of scarlet fever have been very satisfactorily grouped as false relapses, characterized by the appearance of the eruption, with or without the other manifestations of scarlet fever in the course of scarlet fever yet in evolution, or what might be said to be in the febrile stage; secondly, the relapses which were characterized by reappearances of manifestations of scarlet fever in the convalescents from the disease after the fever has fallen to normal. This relapse nearly always began fifteen to twenty-five days after the beginning of the first scarlet fever, and is separated from it by a short afebrile period but coincides with the period of secondary complications involving the lymph nodes, kidneys, or joints; lastly, the recurrences which are really second attacks of scarlet fever after a long period either of months or many years. All of these have been observed and reported by numerous observers.

There have been a number of collective studies made on this subject, among which may be mentioned that of Körner,<sup>2</sup> and of Jeanselme.<sup>3</sup> This latter author enumerates 41 cases, more or less certain, which he has collected from the literature. It is certain that relapses of scarlet fever are very rare, but on this point one cannot be certain as it is possible that some of the cases reported were scarlatiniform German measles or dermatitis exfoliativa, and there are numerous other rashes resembling scarlet fever which might easily be mistaken for it. It is also equally possible that numerous cases of relapse pass unobserved and are not reported. Jacobson's cases are as follows: The first child was six years old and had a very light scarlet fever, characterized by

<sup>1</sup> Archives de Médecines des Enfants, April, 1914, p. 267.

<sup>2</sup> Jahrbuch. f. Kinderheilkunde, 1876, Bd. ix.

<sup>3</sup> Archives Générales de Médecine, June and July, 1872.

fever, sore throat, and a slight scarlatiniform eruption. The fever lasted but a few days, the tongue was typical, and after several days there was a slight desquamation and a little albumin in the urine. This was in May, 1908. Two other children developed the disease in 1911, in Italy, and the last child had the disease in 1911. In November, 1912, the first child had a typical attack of scarlet fever and subsequently three other children developed typical attacks of scarlet fever. Jacobson believes that an explanation of this phenomenon is that scarlet fever is caused by a number of diverse microbic agents possibly very closely related, all of which are capable of producing the clinical syndrome of scarlet fever, and that there exists for scarlet fever a form which bears the same relation to it that paratyphoid bears to typhoid fever. Whether this is the correct explanation, or not, cannot be decided until the organism of scarlet fever has been discovered.

THE USE OF ADRENALIN IN SCARLATINAL NEPHRITIS. Paoloantonio<sup>1</sup> has been carrying on a series of observations on this subject, beginning his work in 1910 in an epidemic of scarlet fever which occurred at Palena. He has made a short report owing to the fact that it is an entirely new method of treatment, and he believes is one which is worthy of further investigation. He used the drug in the acute cases of glomerulonephritis, beginning with injections of one-third of a centigram.

In his first case the hematuria diminished on the day following the treatment, and on the third day it disappeared. This first case received but one injection hypodermatically, and 2 drops of adrenalin chlorid by mouth every three hours. This case was in a child, five years of age, who, on the fifteenth day, started with an edema, vomiting, and headache. The urine became diminished, turbid, and showed large quantities of albumin, casts, and blood. After ten days' time, this patient was in complete convalescence.

All of his cases treated were between two and ten years of age, and the nephritis came on in the second and third week of the disease. In all, he has had experience with 30 cases. In addition to the adrenalin, the patient was placed on a milk diet, with absolute rest in bed. The skin was anointed with oil, and woolen coverings were used. In some cases the drug was administered hypodermatically; in others, it was given by mouth; and in some cases both methods were used. The amount varied with the age of the child and the severity of the disease, but, as a rule, 10 to 20 drops of a 1:1000 solution were administered in each twenty-four hours. The points which he lays particular stress upon are that the patient got well, the period of illness was shorter than it is ordinarily, and uremic symptoms were lessened. He believes this form of treatment to be without danger and of very great value, and urges other physicians to try it in similar cases.

<sup>1</sup> Il Policlinico, Sezione Practica, November 30, 1913, p. 1751.

THE USE OF SERUM IN CONVALESCENCE FROM SCARLET FEVER AND IN THE TREATMENT OF GRAVE CASES OF THAT DISEASE. As early as 1897, Weisbecker tried this method of treatment on 5 cases with what he believed to be very favorable results, and, later, von Leyden obtained certain results in 16 cases. More recently, Reiss and Jungmann used large doses of serum, from 40 to 100 c.c., according to the age of the patient, giving it intravenously. They treated 12 cases which they described as either severe or very severe. They believe that the severity of the disease was notably lessened in these cases.

The last report is by Kock who treated 28 cases, described as severe or very severe, with only one death, and this patient was admitted to the hospital in a dying condition and succumbed one hour after the injection. In the other patients there was a notable fall in the temperature after from six to twenty-two hours. Sometimes the fever remained low; at other times there was a subsequent rise. The serum apparently does not shorten the course of the disease, and the usual complications are as frequent as in those cases not treated, with the exception that no cases of hemorrhagic nephritis occurred in his series. There seem to be differences in the serum and it is suggested that mixtures of various serums be used and that large doses be given in place of small ones. The advances in serum therapy in scarlet fever have been very slow, but each year the reports seem to grow somewhat more favorable.

THE USE OF ANTISCARLET FEVER VACCINE. The pathogenic agent causing scarlet fever is yet unknown but we know very well that it is a contagious disease contracted by exposure to another case of the same disease and that it is an extremely dangerous malady, most of the fatalities being caused by complications. Some authors believe the streptococcus, which is so constantly associated with the disease, to be the cause. Kurt and Klein have given the name of streptococcus conglomeratus to this organism.

Biehler<sup>1</sup> calls attention to the method of using a vaccine which she states is widely used in Russia and Poland, but very little known outside of these countries. Most of the contributions upon this subject have been made by Russian or Polish writers. In 1907, Gabritschewsky described the method which consists of injecting a culture that has been concentrated by the aid of a centrifuge. This culture is obtained by using several strains of streptococcus obtained from different cases of scarlet fever. They are heated to 60° C., after which 0.5 per cent. phenol is added. The sediment obtained is diluted with normal salt solution and this is mixed in the proportion of 1 c.c. of the solution to 5 milligrams of the dry precipitate. One half cubic centimeter is injected under the skin in children from two to ten years of age, and this is

<sup>1</sup> Archives de Médecines des Enfants, March, 1914, p. 193.

repeated at intervals of from seven to ten days. Injections are repeated three times, the second dose being one and one-half times the first, and the third twice the original dose. Double the quantity is used for adults, and one half the quantity for children under two years of age. Something like 50,000 people were vaccinated in 1907 and 1908. The injection produces a certain amount of local reaction and some general disturbance, consisting of headache, slight rise in temperature and sometimes a slight rash. One author, Dorofiejff, described vomiting and also inflammation of the pharynx. The reaction lasts from six to seven days on an average.

The immunity caused by this injection is estimated to last from two months to a year. Niewiedomski vaccinated 19,843 individuals according to his method, and but 1.5 per cent. became infected with scarlet fever and these had only very light attacks and without any fatalities. Quite a number of Russian and Polish physicians have used this method of stopping epidemics, but it has its opponents who claim that the constitutional reaction is entirely too great. Among these may be mentioned Zlatogoroff and Langowoj. Smaller doses of vaccine did not produce the desired effect, but less than that noted above may be used successfully according to some of the Polish writers.

**Septic Sore Throat.** Epidemics of this disease have been reported from time to time since 1875, the English observers being the first to call attention to the disease. During the past three years considerable attention has been directed toward this condition in the United States owing to the fact that there have been several very extensive and devastating outbreaks. In 1910 and 1911 there were over 1000 cases occurring in Boston, and about 70 per cent. of these cases were using milk supplied from one dairy. In 1911 and 1912, there was a very large epidemic in Chicago, and in this case the majority of those affected were taking milk from the same dairy. In 1912, there was a severe epidemic of some 600 cases in Baltimore, some 65 per cent. of which were supplied from one dairy which supplied nearly 3.3 per cent. of the milk sold in Baltimore. There have been numerous smaller outbreaks, and among these are two epidemics which occurred simultaneously in Maine, in 1913, and in Courtland and Homer, New York, the two communities being three miles apart as noted by North, White and Avery.<sup>1</sup> In these epidemics over 70 per cent. of the cases in each community occurred among the patrons of a dairyman who was the only one selling milk to these cases and who supplied less than 7 per cent. of the total milk supply. There were no cases of the disease in the adjacent towns, and no milk was served in these towns from the suspected dairy.

A physical examination of the cows and a microscopical examination of the milk sediments showed the existence of an acute udder inflamma-

<sup>1</sup> Journal of Infectious Diseases, January, 1914, p. 124.

tion in two cows in the herd of the suspected dairyman. A bacteriological study showed that cultures from the throats of four patients contained streptococci which were apparently identical with strains of streptococci obtained from the milk slime from the two cows mentioned above. Cultures from the throats of 8 other patients contained streptococci of the same type, but differing by slight variations in their carbohydrate fermentation. This organism is gram-positive and usually occurs in pairs, existing separately or in short or longer chains. When freshly isolated, the pairs show a capsule differing from the capsule of the pneumococcus in that it is not indented between the individuals in the pairs. It is rapidly lost on cultivation, but reappears after passage through animals. On blood agar, the colonies are surrounded by a distinct zone of hemolysis. It is particularly dissolved by bile, and it acidifies milk with frequent, but not constant, coagulation. Dextrose, lactose, saccharose and dextrin are fermented with acid production, but no gas; while raffinose, mannite and inulin are not attacked. The name of *Streptococcus epidemicus* has been given to this organism by Davis, Hamburger, Stokes and Hachtel.

Capps and Davis<sup>1</sup> have studied an epidemic of this disease which occurred in Jacksonville, Illinois, a city of some fifteen thousand people. The results of their investigations are very similar to those obtained in other epidemics. They found that the streptococcus which causes the disease does not appreciably multiply in room, or warm temperature, owing to the inhibiting influence of other milk bacteria, and they are also killed by the acids of sour milk or buttermilk. In ordinary butter, they usually disappear in a few days, owing, perhaps, to the presence of other acids, but in ice cream they may retain their virulence for at least three weeks. This last is an important factor in the prevention of the disease, as this form of food is particularly liable to spread the disease.

**Sleeping Sickness.** Chatard and Guthrie<sup>2</sup> had occasion to observe a case of human trypanosomiasis in Baltimore. The disease is found in its endemic form only in Africa, whence a considerable number of cases have been imported into the western hemisphere, chiefly in negroes from the west coast of Africa who were transferred to Martinique. In 1911, Camac reported a case in the United States of an engineer who contracted the disease in the Congo region. The patient reported by Chatard and Guthrie was a man, aged thirty-seven, who was born in Belgium, who, at the age of twenty-two, went into the service of the Belgium Government of Africa. In 1908, he contracted sleeping sickness. He had been under treatment for sleeping sickness before coming to America, which he did in 1909, and he remained well until 1911 when

<sup>1</sup> Archives of Internal Medicine, November 15, 1914, p. 650.

<sup>2</sup> American Journal of Tropical Diseases and Preventive Medicine, January, 1914, No. 7, vol. i, p. 493.

his general health became poor. A few weeks before coming under observation he began feeling drowsy, with an indisposition to work, and he found that his cervical lymph nodes were larger than they had been for years. He also had palpitation and dizziness on exertion and wept on slight provocation.

Upon examination, the lips were found to be cyanotic. There was general enlargement of the lymph nodes, but practically nothing else except the symptoms mentioned. Ordinary stained specimens of the blood and fresh preparations were examined without finding the parasite, nor could they be found in thick smears or in concentrated blood. The blood inoculated into white rats did not cause any changes, the cerebrospinal fluid contained no parasites, neither on examination nor injection into animals. The serum obtained from one of the lymph nodes on the right side of the neck contained one motile trypanosome. He was treated with 0.55 grams of salvarsan given intravenously. He improved immediately, and a short time afterward he disappeared and returned to Belgium. Two years later it was found that he had been admitted to one of the hospitals near Brussels in a comatose condition, evidently in the last stages of the disease. The chief interest in this case is that it is a second case reported in the United States and that one should be on the lookout for cases of this malady in individuals who have been in South Africa. With the ever increasing traffic between the two countries, cases are certain to be introduced from time to time.

**Smallpox.** TREATMENT OF SMALLPOX WITH SODIUM NUCLEINATE. Various preparations of nuclein have been suggested in the treatment of infectious diseases, owing to the fact that they cause an increase in the number of leukocytes. Among those that have been used are nucleinic acid and sodium nucleinate. Many of these experiments have been carried on in Russia, and among these may be mentioned the work of Pissarev in Asiatic cholera, in which he claims to have used hypodermic injections with success. Blumenau also claims to have obtained excellent results in erysipelas, and Moliakov in scarlet fever. On the contrary, Skorodoumov states that the course of scarlet fever is not affected at all by this drug, and, according to his experience, it is equally useless in the treatment of typhoid fever.

Fedotov<sup>1</sup> has used subcutaneous injections of a 10 to 15 per cent. solution of sodium nucleinate in smallpox, both in children and adults. The adult dose was from 1 to 2 grams daily, in the average case, and from 2 to 3 grams a day in the severe ones. The dose for children averages 1 gram. The drug may also be given by mouth, although the observers believe it to be more effective when administered subcutaneously. It may be commenced at the beginning of the eruption and continued up to the time when the pustules begin to dry. In all, 40 cases were

<sup>1</sup> La Semaine Médicale, July 15, 1914, p. 328 and Vratheeb. Gaz., June 15, 1914.

treated, the results being remarkable, in that there was no suppuration in the vesicles, even in the most severe cases, and the odor, characteristic of the disease, was absent. Following the separation of the scabs there was very little scarring. Out of 40 cases, there were 7 with complications. The drug seems to have no action for controlling the temperature, although the temperature was uniformly lower, owing to the absence of suppuration. The defervescence began between the twelfth and the fourteenth day, which is much earlier than in the control cases. For these 40 cases, the mortality was lower than in the cases treated under the same conditions without the drug.

**Sporotrichosis in the Mississippi Basin.** In *PROGRESSIVE MEDICINE*, March, 1913, I called attention to the studies of Hamburger, who collected 58 clinical cases in various parts of the United States, 28 of which were confirmed by laboratory studies. Since Hamburger's publication, there have been 10 additional cases reported, 9 of which were seen in the Mississippi Basin. In the original study, 54 out of 58 cases were also found in this locality.

Sutton<sup>1</sup> has reported 5 additional instances of this disease, 3 coming from Kansas, 2 from Missouri; the lesions in all the cases starting upon the arms. Sutton is of the opinion that, in spite of the numerous contributions on this subject, many cases of the disease pass unnoticed, and he believes that, in order to give a more widespread knowledge of the clinical appearance of this disease, all cases should be reported. He particularly recommends that when the disease is suspected, the bacteriological test should be made as early as possible, because the use of strong antiseptics, such as iodine, may interfere with the growth of the cultures, even though the fungus is present.

In most instances, the appearance of the disease is characteristic. It may not be inadvisable to call attention briefly to the clinical varieties of the disease which Beurmann describes under four headings:

1. Localized sporotrichosis with an initial lesion followed by involvement of the lymph vessels and nodes.
2. Disseminated gummatous sporotrichosis characterized by multiple nodules distributed without systematic arrangement throughout the body. These begin as small hard, painless round masses, which do not ulcerate, but which later on give rise to cold abscesses.
3. Disseminated sporotrichosis characterized by multiple ulcerations sometimes suggestive of furunculosis, at other times suggestive of tuberculosis or syphilis, or of combinations of these.
4. Extracutaneous sporotrichosis, with localization on the mucous membranes, muscles, bones, joints, ocular tissues, lungs, etc. Clinically, one may suspect sporotrichosis when any of the above lesions are found, especially when it occurs in individuals handling fruit or vegetables,

<sup>1</sup> *Journal of American Medical Association*, October 3, 1914, vol. lxiii, p. 1153.

with the history of an injury, and a gradual slowly progressing onset with an infection following the course of the deep lymphatics.

**Sprue in the United States.** Sprue is a tropical disease generally regarded to be communicable. It is manifested clinically chiefly by gastro-intestinal symptoms; stomatitis, diarrhea, atrophy of the intestinal mucous membranes, atrophy of the liver, and a secondary anemia with loss of weight and strength. The course of the disease is extremely chronic, and a remarkable tendency to relapse exists. Sprue may be suspected when the patient has a rather red, bald-looking tongue and a diarrhea with rather characteristic stools. These are large, with a disagreeable odor, a strong acid reaction, and uniformly mixed with fine bubbles of gas. Microscopically, fat droplets may usually be demonstrated, showing that there has been little fat digestion.

In Great Britain, it has been noticed that many missionaries to tropical countries are returned home as invalids, and sprue forms a certain percentage of the causes of this. The only countries sending figures are Central and Southern China. These figures are 2.5 and 5 per cent. respectively.

The disease is prevalent in Porto Rico, and Hyatt and Allen<sup>1</sup> have reported 5 cases; 3 from Porto Rico, and 2 from China, and an additional case of a native of the United States, who probably had the disease. It has been suggested by various authors, including Stewart, Bernett and Jackson, that sprue and pellagra are the same disease. In other words, that sprue is pellagra without the skin manifestations. Hyatt and Allen wonder, from their experiments, that the two diseases can be confused. They make a plea for the more careful study of individuals returning from tropical countries with diseases which are not ordinarily found in the United States.

**A Case of Infection with the Dog Tape Worm.** This species of tape worm very rarely affects human beings. It is ordinarily found in dogs or cats, and in the larval stage it lives in dog lice or dog flea, and the human flea. It has been variously named, but it is now generally referred to *Aipilydium caninum*. It is originally called the *Taenia canine* by Linnaeus, the *T. cucumeria* by Bloch and *T. elliptica* by Batsch. A case has recently been reported by Vincenzo.<sup>2</sup> He collected 61 cases from the literature in children under eight years of age, 2 cases in children from thirteen and fifteen, and 6 cases in adults ranging in age from twenty to fifty-five years. The parasite has been found in various parts of the world where scientific investigations were undertaken. Stiles and Duffield have each reported cases in the United States and the others were found distributed as follows: France 4, Germany 16, India 2, Austria 3, Denmark 2, Ireland 1, Norway 1, Russia 3, Sweden 1, Switzerland 7, and Italy 2. The infection evidently takes place in

<sup>1</sup> Journal of American Medical Association, August 1, 1914, p. 395.

<sup>2</sup> Il Policlinico, Sezione Practica, March 29, 1914, p. 458.

children playing with dogs or cats that are infected. The worms were present in the intestine in varying numbers. Sometimes but very few have been found, sometimes from forty to fifty, while in other cases they have been present by the hundreds.

**Tetanus.** INTRASPINAL ADMINISTRATION OF TETANUS ANTITOXIN. Tetanus antitoxin has proved to be a very valuable preventative of the disease, and is used for this purpose with rather uniformly good results, both in human beings and in animals. It has not, however, produced the results expected of it in the treatment of the disease.

Park and Nicoll<sup>1</sup> have considered this subject and reviewed our information in regard to the intraspinal use of tetanus antitoxin, together with their own experiments. They regard the failures as due to insufficient doses, and the use of subcutaneous methods of injection. The failure of the subcutaneous methods consists in the slow absorption of the antitoxin, and the time required to reach the tissues of the central nervous system. To be effective when given in this manner, it should be given in large doses, and within a few hours from the onset of the symptoms.

Various reports have been made since 1903 on the intraspinal use of tetanus antitoxin. When employed before the disease has made too much headway, the results are far superior to those obtained by the subcutaneous injections. In 1905, Neugebauer reported 43 cases from continental and American sources, with a mortality of 22, or 51 per cent. Three were patients of his, 2 of whom recovered. Some of these cases were treated both by intravenous and subcutaneous injections. Permin, of Copenhagen, using dogs, showed that local tetanus could be prevented if at the same time that the injection of tetanus toxin was made, a dose of tetanus antitoxin was given intraspinaly. With the same doses of antitoxin intravenously, local tetanus occurred. In these animals, if four hours elapse after giving the toxin, neither method was efficacious, and if nine hours passed between the giving of the toxin and the antitoxin, the animals were lost.

The work of Park and Nicoll consists partly of their experience in experimental tetanus in guinea-pigs, and partly in human cases. Their experiments on animals show that the intraspinal method was far superior to the method of giving the antitoxin intravenously, and that results could be obtained by using only a fractional part of that given in the circulation. Since beginning their work, they have treated 4 cases in human beings. The first was a boy, nine years of age, in whom the incubation period of the disease was nine days or less. The case was severe, with many convulsions. Six hours after the locking of the jaws, 3000 units of tetanus antitoxin were given intraspinaly, and 10,000 in the veins. There had been a facial paralysis present on the

<sup>1</sup> Journal of American Medical Association, July 18, 1914, p. 235.

side of the head on which the wound had been received thirty-six hours previous to the injection of the antitoxin. Including the first dose the amount of antitoxin given amounted to 52,000 units. It was all given either intravenously or subcutaneously, with the exception of the first dose. The patient made a good recovery. The second case was that of an adult male, also with an incubation period of nine days. The treatment was begun nine hours after the stiffness of the jaws came on. Fifteen hundred units of antitoxin were given in the tissues around the wound and intraneurally, 3500 intravenously, and 300 subcutaneously; the next day, 1300 units were given intravenously, 8000 intraneurally, and 7000 intraspinally. On the third day the patient continued to grow worse, and 9000 units were given intravenously, 8000 intraspinally and 7000 units into the tissues of the wounded foot. Two days later the rigidity was less, and the patient was able to swallow. On this day 7500 units were given in the vein and the next day 5000. The blood showed 6 units of antitoxin to the cubic centimeter. The patient recovered. The intraspinal injections were given so late in this case that it is doubtful whether or not they can be credited with the cure. The third case was that of a boy, aged nine years. The incubation period was not known, but was not over two weeks. Symptoms were present for two days before the treatment was begun. He was given 5000 units intraspinally, 3000 subcutaneously, and 10,000 intravenously. The next day, 5000 units were given intraspinally. This patient made a good recovery. The fourth case was that of a child of six years with an incubation period of ten days. Three thousand units were given intraspinally in the afternoon of the day on which the symptoms were first noted. Thirteen hundred units were given at the same time intravenously. The subcutaneous dose was given under the muscles. This patient also recovered.

These results are so much better than those ordinarily obtained by the use of antitoxin given by the subcutaneous method, or intravenously, that in spite of the small number of cases, they are very suggestive. The authors suggest that in each case strongly suspected of being tetanus, from 3000 to 5000 units of antitoxin should be given as early as possible, and that it should be administered intraspinally. The injections should be given by gravity, slowly, and if possible, under an anesthetic. If necessary, the antitoxin should be diluted to a volume of from 3 to 10 c.c. or more in order to secure thorough dissemination throughout the spinal meninges. The spinal fluid should be drawn off previously, and a somewhat greater amount should be withdrawn than is to be given in the injection.

Inasmuch as a number of instances of spinal puncture have been observed by those thoroughly familiar with the procedure, and in such a manner as to leave no room for doubt that the canal was properly entered, without withdrawal of the spinal fluid, the suggestion has been

made that only from 3 to 5 c.c. of the tetanus antitoxin should be injected under these circumstances.

In human tetanus there is often a focus which is supplying more and more toxin, and in order to neutralize this as quickly as possible, it is suggested that from 10,000 to 15,000 units of antitoxin be given intravenously and a similar dose subcutaneously three or four days later. This will insure a highly antitoxic condition of the blood during the next five days. The authors do not believe that there is any advantage in giving larger doses of antitoxin than the ones indicated.

The intraneural injection is an uncertain and difficult method and it usually proves less satisfactory than the intraspinal injection. In addition, the proper surgical treatment of the wound should not be neglected, and the ordinary medical treatment, in the way of sedatives and stimulants, should not be forgotten.

In connection with the above, the analysis of 225 cases treated between 1907 and 1913 by Irons<sup>1</sup> is of interest. Without serum, it is stated that, from hospital statistics, the mortality varies between 78.0 per cent. and 89.3 per cent., the latter figure being from the records of the American Civil War. There are great variations, however, depending on various factors, the length of incubation period, the rapidity of development of symptoms after the beginning, and so forth. It is hardly necessary to reproduce the tables of Irons which are, however, of great interest. They show that, combining all classes of cases, the mortality of cases of tetanus treated with antitoxin is 20 per cent. less than the average mortality of cases treated without it. The results of treatment by means of large doses given intraspinally or intravenously are very much better than those achieved by the use of smaller doses given subcutaneously. The suggestions for dosage given above are concurred in by the author.

In addition to the above, MacConkey<sup>2</sup> has contributed an article dealing with the prevention and treatment of the disease by means of antitetanus serum. His article is of considerable interest, inasmuch as it gives briefly, yet rather completely, a review of the whole subject from the beginning of Nicolaier's experiments in 1885 to the present time. The suggestions of prophylaxis and treatments are essentially the same as those which were given above. The article also contains a satisfactory bibliography of the recent contributions. He also has a note on the subject of antitoxin units, and it must be borne in mind that different standards are used in different countries.

The standard antitoxin unit in the United States does not correspond to that used in Germany, one German unit being equal to about 40 units of the United States. The French usually refer to antitoxin in doses of cubic centimeters, 10 c.c. of the antitoxin of the Pasteur Institute

<sup>1</sup> *Journal of Infectious Diseases*, September, 1914, p. 367.

<sup>2</sup> *British Medical Journal*, October 10, 1914, p. 609.

usually contains from 500 to 1000 units of the United States. Tizzoni used another standard, and considered 200,000 of his units as an ordinary prophylactic dose. One bottle of his serum containing 5 c.c. which was examined by MacConkey was found to contain 125 United States units. The unit used in the United States is ten times the smallest amount of serum necessary to preserve the life of a guinea-pig weighing 350 grams for ninety-six hours, when given together with an official test dose of toxin. The test dose of toxin consists of 100 minimum lethal doses, the minimum lethal dose being the smallest amount of toxin which will kill a guinea-pig weighing 350 grams.

TETANUS AND FOURTH OF JULY INJURIES.<sup>1</sup> The twelfth annual summary of the Fourth of July injuries shows that the campaign against tetanus, incidentally other injuries, continues to be successful. In 1914, there were only 3 cases of tetanus, one in Kentucky, one in Minnesota, and one in New York. All of these cases died. Two were injuries to the hand due to the use of blank cartridges, and one was an injury to knee, due to fire arms. The patients were thirteen, fourteen, and ten years of age. An annually marked effort was made to secure complete and accurate data, and the figures given in this article may be considered reliable. The blank cartridges appear to be responsible for a large majority of the cases. A table showing the ration of the tetanus cases to blank cartridge injuries is interesting.

Year.	Tetanus cases.	Blank cartridge injuries.	Ratio.
1903 . . . . .	417	1672	1: 4.01
1904 . . . . .	105	905	1: 8.62
1905 . . . . .	104	809	1: 7.78
1906 . . . . .	89	979	1:11.00
1907 . . . . .	73	606	1: 8.30
1908 . . . . .	76	942	1:12.39
1909 . . . . .	150	1225	1: 8.17
1910 . . . . .	72	450	1: 6.25
1911 . . . . .	18	185	1:10.28
1912 . . . . .	7	75	1:10.71
1913 . . . . .	4	97	1:24.25
1914 . . . . .	3	122	1:40.67
Totals . . . . .	1118	8067	1: 7.22

It will be seen that in 1903, the ratio of tetanus cases due to blank cartridge injuries was 1 to 4.01, whereas in 1914, it was 1 to 40.67. The difference in the ratio being largely due to the greater care in treating wounds due to blank cartridge injuries, and also to the use of tetanus antitoxin as a preventative. In this connection, a table showing the cause of tetanus cases is important, and it will be seen that the cases of tetanus vary almost exactly with the number of cases of blank cart-

<sup>1</sup> Journal of American Medical Association, August 29, 1914, p. 777.

ridge injuries. During July, there are always a certain number of cases of tetanus, due to wounds from nails, splinters, crush injuries and the like, but owing to the more common use of tetanus antitoxin, and the better local treatment there has been a reduction of this.

Table showing the causes of Fourth of July tetanus:

Year.	Blank cartridge.	Giant cracker.	Cannon.	Fire- arms.	Powder, etc.	Total.
1903 . . .	363	17	5	3	29	417
1904 . . .	74	18	5	1	7	105
1905 . . .	65	17	4	5	13	104
1906 . . .	54	17	1	7	10	89
1907 . . .	52	8	6	4	3	73
1908 . . .	58	5	4	3	6	76
1909 . . .	130	9	1	4	6	150
1910 . . .	64	2	..	5	1	72
1911 . . .	15	1	1	..	1	18
1912 . . .	7	..	..	..	..	7
1913 . . .	4	..	..	..	..	4
1914 . . .	2	..	..	1	..	3

Table showing the number of cases of tetanus due to other causes since 1908, the first year in which they were collected:

Year.	Cases.
1908 . . . . .	166
1909 . . . . .	128
1910 . . . . .	47
1911 . . . . .	29
1912 . . . . .	44
1913 . . . . .	32
1914 . . . . .	16

From a study of the ordinances, and other measures used to prevent Fourth of July injuries, it will be seen that the responsibility certainly rests with the city government. In some cities, such as Baltimore, Cleveland, Newark, Trenton, Chicago, and Washington, prohibitive ordinances have given most effective results. It would seem that any city that desires may become practically free from Fourth of July injuries and consequently from Fourth of July tetanus, while the prohibition of blank cartridges will also do a great deal to reduce the number of cases.

**Trachoma.** Among the diseases that formerly attracted very little attention, and which have caused very widespread suffering in the United States, is trachoma. I have noted previously the work being done by the United States Public Health Service in determining the severity and prevalence of trachoma in various parts of the United States. Several additional surveys have been published, including the one of the mountain sections of Virginia, and West Virginia, by Clark;<sup>1</sup> of the mountain section of North Carolina and South Carolina,

<sup>1</sup> Public Health Reports, June 5, 1914.

by Foster,<sup>1</sup> and one of the mountain section of Eastern Tennessee, and Northern Georgia, by Bailey.<sup>2</sup>

In North Carolina, the disease exists only in isolated localities, there being three different foci in different parts of the State. The origin of the disease is not at all clear, and it is evident that it has existed for a long while. In one locality, that of Cherokee County, where there is an Indian school, it is believed that the disease may have been communicated by the Indians. In one of the other districts, the disease is supposed to have dated from the construction of a railroad, upon which, from time to time, a considerable number of foreign laborers were employed.

Taken as a whole, however, foreign immigration does not appear to have been a factor in the extension of the disease. Inasmuch as the infection is rather light, the negro was found to be practically free from it. The recommendations in this State are merely for the treatment of existing cases to prevent further spread of the disease.

In Virginia and West Virginia, particularly in the former, the disease is very prevalent, and is present in a sufficient degree to make it one of the serious problems of public health. The counties of the eastern edge of West Virginia are apparently free from it, but this is probably due to the fact that there is very little communication with other parts of the State because of the existence of no direct routes of communication. There have been no systematic efforts made to control the spread of the disease, and people with trachoma are allowed to go about freely from place to place.

The disease is one of the causes of a considerable amount of damage to vision, and as many as 5.95 per cent. of treated cases suffer with marked disturbance to sight. This leads to increasing illiteracy, and it was found that, as a matter of fact, wherever trachoma is particularly prevalent, the degree of illiteracy is very marked.

In Eastern Tennessee the disease is also found. There is very little in Georgia, and only in three contiguous counties adjoining South Carolina and Tennessee. The largest number of cases is found in the counties bordering and close to the Kentucky State line. A large number of the cases seen were in the incipient stage, and had previously been unrecognized. These incipient cases form a dangerous type from an epidemiological standpoint, as they are more able to cause a spread of the disease than the older cases, there being no effort made to avoid contact with such persons. Here, again, there was no relation to be traced between foreign immigration, and the negro was found practically free from it, except in a locality where the infection was particularly severe.

In former years, considerable stress was laid upon the fact that

<sup>1</sup> Public Health Reports, July 10, 1914.

<sup>2</sup> Ibid., September 18, 1914.

trachoma occurred chiefly in the mountainous districts, and at one time it was thought that the physical features of the country might have something to do with the occurrence of the disease. From the various studies that have been made, it was seen that this fact is only of importance as it influences the life of a community. In most of the States, the severest infections are found in the most isolated parts of the State, and, with these as the foci, the disease has spread along the lines of travel. The reason of its being more prevalent in these localities is due to the unsanitary conditions of the homes, the lack of observation of even the simpler rules, and particularly the lack of medical services in the diagnosis and treatment of the disease. In the absence of any knowledge upon the subject of trachoma, the disease has been allowed to spread without any attention. The use of the common towel in boarding houses, cheap hotels, railway stations, and trains, perhaps, contributes to the spread of the disease.

Where trachoma has got a foothold, the only way to eradicate it is by systematic effort, which should begin with a campaign of education, especially through talks to school children and the distribution of printed literature, concerning the danger of the disease, and how to prevent it. Systematic examination should be made of all children, and all with active trachoma should be excluded from the schools, until they are no longer a danger to others. Where it is possible to employ one, a school nurse visiting the homes of the children found to be infected will be found a great help. The nurse, in these cases, can see that the treatment is carried out, and can educate the family in each case in regard to it. This is of particular importance, inasmuch as one case of trachoma is rarely found in a family, almost invariably several members are found with the disease.

In addition to the examination of school children, an examination of laborers in mines should be made, and free hospitals for the disease should be located at points of importance. These hospitals could be of inexpensive construction, and some sort of portable building which could be moved about from place to place could be made to answer the purpose.

In the examination of the eyes, there should be a complete eversion of the eyelids, so that the retrotarsal fold is exposed, and the physician in infected neighborhoods should be taught how to diagnose the disease. A very large number of physicians in practice are not familiar with trachoma, and many have never had an opportunity of seeing it during their course of instruction, and they are not prone to pay much attention to the disease of the eye after leaving the medical school.

The disease could be combated best, perhaps, by some sort of foundation similar to that of the Rockefeller foundation for the eradication of hookworm. But until some such foundation should be made by some philanthropist there should be a systematic coöperation between the health authorities of the nation and States.

**Trichinosis.** Van Cott and Lintz made a study of some cases of trichinosis in which they made an examination of the cerebrospinal fluid obtained by lumbar puncture to determine whether the nervous symptoms sometimes met with are not due to the presence of the parasite in the central nervous system. About 40 c.c. of fluid were obtained from one patient; this showed a slight grayish-white sediment, and contained the usual traces of albumin, and Fehling's solution was not reduced. The centrifugalized sediment examined microscopically showed a number of lymphocytes and young actively moving trichinae about 1 mm. in length. Six parasites were found in the first preparation and, after keeping the cerebrospinal fluid in an ice chest for five days, actively moving trichinae could still be found. This is perhaps the first time that the parasites have been demonstrated in the cerebrospinal fluid. Some ten years ago, Herrick and Janeway demonstrated the trichinae in the circulating blood. In addition to this particular feature, they brought out several other things in connection with the disease. From the standpoint of therapeutics they did not believe that intestinal antiseptics have any influence upon it and that salvarsan is useless. They also believe that a child is not in danger by nursing from the infected mother. From their studies they also determined that neither the leukocytes nor the eosinophilia is any index of the severity of the disease.

**The Insect Transmission of *Trypanosoma Evansi*.** A certain number of experiments have been done on surra, and while this article is not supposed to deal with the diseases of the animals, the work which has been done upon this disease is of considerable value to those interested in the transmission of infectious diseases by insects.

Mitzmain<sup>1</sup> has made a number of studies and collected a considerable amount of information concerning this disease. As early as 1901, Rogers, working in India, used horse flies, the species not being mentioned, which were collected and kept for varying periods of time, after being allowed to bite and suck the blood of an animal which was suffering from surra, and whose blood at that time contained the *Trypanosoma evansi* in large numbers. When the flies were kept from one to four days or more and allowed to bite horses, dogs, and rabbits, no disease ensued, but when the flies were immediately allowed to bite another healthy animal, positive results were obtained, the incubation period being the same as when a minimum dose of infected blood is inoculated into an animal of the same species.

In 1908, Fraser and Symonds, were able to convey the disease from animals to animals in this same manner. The species of horse fly used in their experiments were *Tabanus minimus*, *T. paritus*, *T. vagus*, *T. fumifer*.

<sup>1</sup> Bulletin of the Hygienic Laboratory, United States Public Health Service, 1914, No. 94.

In 1905 and 1906, Ed. and Et. Sergent carried on a series of experiments in the transmission of certain diseases found in Algeria, and due to a certain species of trypanosomes; these are magana, dourine, and zousfana. They were able to transmit all three diseases by means of two species of tabanids.

Subsequently, Bruce and his collaborators, in 1910, were also able to transmit the trypanosomes of an African cattle disease (*Trypanosoma pecorum*) by means of three different species of tabanids. This disease was also transmitted by the direct mechanical method of transmission.

Leese, in 1911, succeeded in transferring surra, not only with horse flies, but also with other breeding diptera, a certain species of *Haematopota* being used.

Mohler and Thompson studied the disease in Indian cattle and found that the only breeding flies present were three species of *Tabanus*, and one *Stomoxys*. They believe that the *Tabanus striatus* were responsible for the outbreak. Mitzmain believes that the common house fly of the Philippine Islands, the *Tabanus striatus*, was capable of transmitting surra, and for the first time used fly blood especially for the purpose, thus eliminating errors resulting from naturally infected wild flies. Three successful experiments with direct or mechanical transmission by the breeding of these insects are reported. The *Trypanosoma* of surra were found not to be transmitted hereditarily in these insects. It was also found that fifteen minutes after feeding, the flies were no longer capable of transmitting the disease. All efforts of obtaining infection by indirect methods, that is, of keeping the flies for various lengths of time, were negative.

He also experimented with the mosquito, including the *stegomyia*, and a species of *culex*. In a large series of experiments, it was found impossible to transmit the disease by means of these insects. This was in accord with previous experiments of Curry, of Leese, and also of Cator. Two experiments of Denton and Haddington had similar results. Mitzmain also investigated the question of transmission of the disease by means of certain blood sucking insects (flies), including a *Philæatomyia crassirostris*. Only one of his experiments with these insects proved positive.

The experiments with *Hippobosca maculata*, as also experiments with blood sucking gnats, two varieties being used, the *Culicoides judicaudus* and the *Phlebotomus*, had like results.

A number of experiments made with the common house fly, *Musca domestica*, and the stable fly, *Stomoxys calcitrans*, showed that the disease might be transmitted by the house fly if there were abraided surfaces upon which to deposit the *Trypanosomes*. The experiments made to show that the common house fly could transmit the infection by depositing the trypanosomes on the wound made by the biting of the stomoxys were negative.

In this connection it is interesting to note the experiments that have been done upon the transmission of anthrax by biting flies, which will be found in this issue under the heading of anthrax.

**Tuberculosis.** THE FRIEDMANN TREATMENT FOR TUBERCULOSIS. In March, 1913, the Public Health Service appointed Anderson and Stimson to study the methods used by Friedmann and to also study the bacillus which he was using. The enormous amount of newspaper notoriety that the Friedmann cure obtained was entirely out of proportion to what it merited. The warnings of the profession at that time were accounted professional jealousy, and there were numerous lay writers who published most bitter invectives against the unprogressiveness of the average physician. The disappearance of Friedmann from this country and the total collapse of his work are, perhaps, sufficient to prove that, as he used it, there was certainly nothing in his treatment.

The reports of Anderson and Stimson<sup>1</sup> give the following conclusions: The claim made for his method is that by means of injections of a living acid-fast organism, harmless of itself, he is able to cure cases of tuberculosis, pulmonary or otherwise, which are not already advanced to the hopeless stage where death is imminent. Friedmann's own reports consisted practically of successes only. Incidentally, it claimed that a method had been devised for the administration of living acid-fast organisms without the formation of abscesses, a complication which has hitherto limited their employment. Anderson and Stimson found that the preparation used is not strictly devoid of dangerous properties of itself, and still less so when injected into tuberculous subjects. It was found that, in some cases, abscesses did occur as a result of the injection. In the large proportion of cases treated with a number of injections in the test cases, while there is some effect, it is not sufficient to materially alter the course of the disease. In a small proportion of the cases the results were advantageous to the patient, and in another small proportion it resulted in definite injury.

"The organism used by Friedmann differs from any previously described, in its cultural characteristics, as regards animal experiments.

"The subcutaneous and intramuscular inoculation of animals with the Friedmann organism caused the formation of abscess in over 25 per cent. of the animals treated.

"The treatment of animals with the Friedmann organisms—rabbits and guinea-pigs—either before or subsequent to infection with virulent tubercle bacilli, is followed, as a rule, by an increased susceptibility to the disease.

"Inoculation of monkeys with the Friedmann culture did not show either curative or protective action in those animals against tuberculosis."

<sup>1</sup> Hygienic Laboratory Bulletin, October 1914, No. 99, and Public Health Reports, November 6, 1914, p. 2988.

THE RESULTS OF THE CAMPAIGNS IN SWITZERLAND AGAINST TUBERCULOSIS. Rucker and Kearny<sup>1</sup> have commented at some length on the results of the campaigns in Switzerland, basing their article upon the work that has been published in the *Bulletin of the International Office of Public Hygiene*, Paris, October 1913, Vol. 5, No. 10, p. 1789, by Dr. Schnud. In 1891, the Swiss Society on Public Utility named a commission to study methods to overcome tuberculosis, and, in the same year, at the time of the celebration commemorating the city of Berne, it was decided to create a municipal tuberculosis hospital. Since that time twelve sanatoria have been established and extensive enlargements have been made in those established in the earlier years. In some of the cantons there is one bed for tuberculosis for every 3000 inhabitants. The annual running expenses of these twelve public sanatoria, which contain about 12,000 beds, were between 600 and 700 francs per bed (\$120 to \$140). Most of the expenses are met by voluntary contributions. The results obtained from 1905 to 1911 in the public sanatoria, in patients who were inmates for more than four weeks, showed that 82.7 per cent. improved, 16 per cent. were unimproved, 1.3 per cent. died in the sanatoria. On the basis of 100 cases treated there were 37.7 in the first stage of the disease, and 32.2 in the third stage of the disease. Leaving out the cases that had occurred in children, the patients on leaving the hospital showed a very considerable capacity for work.

Capacity for work.	First stage.	Second stage.	Third stage.	Average.
Able to perform hard work . .	86.7	58.8	25.6	58.0
Able to perform light work . .	10.3	28.5	34.8	23.9
Able to perform only very light work . . . . .	2.0	11.5	36.6	16.7
Died in sanatorium . . . . .	0.1	1.0	3.0	1.4

In 1905, Burckhart, of Basel, made a comparison of the results obtained in pulmonary tuberculosis for the same age, and situated in the same surroundings in the Basel Policlinic, with those who were cured in a public sanatorium treated in a different way, with or without open air treatment in the neighborhood of Basel, and it was found that the sanatorium treatment increased the resisting power so that the frequency and fatality of intercurrent diseases was much less. This is also evident in the ability to work, as is shown in the following table:

Condition.	End of three years.		End of six years.	
	With treatment in sanatorium. Per cent.	Without treatment in sanatorium. Per cent.	With treatment in sanatorium. Per cent.	Without treatment in sanatorium. Per cent.
Able to do full work	79	39	58	21
Not able to do part of full work . .	7	23	7	21
Died . . . . .	14	33	34	55

<sup>1</sup> Public Health Reports, December 26, 1913, p. 2813.

The average length of treatment varied in the Swiss public sanatoria from between eighty to one hundred days, in some of the institutions; from one hundred and fifty days to one hundred and eighty in others, but the end results were approximately the same regardless of the shorter or longer course of treatment. In addition to the establishment of sufficient sanatoria, a great deal has been done in the public education, and also in the establishment of dispensaries. There are 120 dispensaries modeled along the lines of the French and German institutions of the same class. Pavilions for severe cases of tuberculous infections have been added recently to a number of the sanatoria, and there is one farm colony where cured patients are placed for the time being in connection with the sanatoria at Leysin. In addition to this, very careful work has been carried on in regard to children, providing dispensaries for infant feeding, day nurseries and public nurseries, and a number of camp and open air resorts for treating debilitated and afflicted children. In 1912 over 12,000 children were cared for in 265 camps, and the average stay was two hundred and five days, and this was done at the cost of two francs per day per child (40 cents). There has been a steady lowering of the death rate from tuberculosis, practically all of which has taken place in lessening the deaths from pulmonary tuberculosis. In the period from 1876 to 1880 there were 22.3 deaths from tuberculosis per 10,000 inhabitants, in 1906 to 1910 there were 17.1 on the same basis of calculation. Since 1901, the statistics are more reliable. In that year there were 19.1 deaths from pulmonary tuberculosis from 10,000 inhabitants and this has dropped steadily until 1910 when the rate was 16.3. There are a great many other points brought out in the report of Schnud. The chief thing is that it shows what can be accomplished by a systematic campaign against tuberculosis.

**Fevers of the Typhoid Group.** Riesman<sup>1</sup> has reported several cases of fever which, while resembling typhoid, evidently were not, and inasmuch as the tests for the paratyphoid were also negative, he concluded that he was dealing with another disease of the typhoid group and, following the suggestion of Hare, he thinks that these and all the other similar fevers should be grouped under the head of *entericoid fever*. Future study will undoubtedly clear up the mystery which surrounds those fevers which have been described under so many names. In the absence of any specific therapy, it would seem to me that we have had already a sufficient number of names attached to these diseases. They might properly be called the typhoid group, or, if one wished to be more exact, the paratyphoid group. In addition to typhoid fever, which may now be separated from the other fever by bacteriologic and serologic tests, there are other cases closely resembling typhoid known as the paratyphoid A and due to a bacillus resembling the typhoid bacillus

<sup>1</sup> Journal of American Medical Association, December 20, 1913, p. 2205.

but with distinct serological reactions. The paratyphoid A, like typhoid, seems to be a disease of human beings. The second disease, known as paratyphoid B, is caused by a bacillus apparently widely distributed, particularly in the lower animals used for human food. This bacillus has also been called the *Bacillus enteritidis* of Gärtner. There are some who believe that Gärtner's bacillus and paratyphoid B are two distinct organisms and, as a matter of fact, there have been described a number of bacilli all more or less alike, though with apparently slight differences. They are all capable at times of causing a disease in human beings.

The symptom-complex so caused more or less resembles that produced by the paratyphoid B. The diseases grouped as paratyphoid B will then include infections with Gärtner's bacillus which generally, though not always, enters the body in contaminated meat and was formerly described as meat poisoning and sausage poisoning, and known by various other names. Now it is referred to by the laity as ptomaine poisoning followed by fever.

The other diseases of this group include the fever due to the *Bacillus suipestifer*. This is not the bacillus of hog cholera, but is always associated with the virus causing that disease and seems to be widely distributed. This organism has not been definitely associated with human disease, nor has it been definitely separated from the paratyphoid B. The bacillus causing the disease in parrots, described as *Bacillus psittacosis*, occasionally causes disease in human beings and is also indistinguishable from the paratyphoid. There is, in addition to this, an epidemic disease of mice caused by *Bacillus typhi murium* which is apparently identical with paratyphoid B and which may or may not cause disease in human beings. The exact part played by this organism has not been definitely worked out. A similar disease has been described by Moria in cats. Whether, or not, further study will show that these organisms are really identical, or are merely closely related members of the same group, time alone will tell. In the meantime, for clinical purposes, it is wise to group them together. Many of the articles dealing with this disease are so complicated and so much at variance, until very positive information is to be had, there seems to be no reason to make endless minor distinctions, a point which Riesman endeavors to bring out.

**Typhoid Fever.** In spite of the large amount of work which has been done upon typhoid, there are still a great many epidemics which seem very unnecessary. As an example of this type of epidemic, one which occurred at Rockville, Md., may be mentioned. This was reported by Lumsden,<sup>1</sup> of the Public Health Service. The epidemic occurred in January, 1914, during which month 17 cases of the disease developed.

<sup>1</sup> Public Health Bulletin, May, 1914, No. 65.

Inasmuch as the epidemic came on suddenly in winter and was localized, it was thought that the infection was being disseminated either by water, milk, or some food supply used by a large number of the inhabitants. Without going into the details of the study of this epidemic, it may be stated that the disease was distributed more or less uniformly through the town, and also with regard to occupation and age. There is no history of personal contact to amount to anything and sufficient evidence was collected in regard to the food supply of the patients to practically eliminate that source of infection. All of the cases gave evidence of having used the town water and an investigation showed a large number of wells containing the colon bacillus. The town water supply was evidently infected through a previous case of typhoid fever, the drainage of the house from this patient having probably travelled by way of a secret ditch into one of the wells.

The lessons to be learned from this epidemic, which was promptly controlled by the usual sanitary methods and the use of hypochlorite of lime for purifying the water, have been called to the attention of the public so many times, that were it not for the necessity of forcing the lesson home, one would hesitate to mention it. If proper precautions had been taken at the bed-side of the first patient at the very beginning, the outbreak would not have occurred, and if the town had been provided with sanitary privys or proper sanitary water-closets, the epidemic would probably not have taken place. The criminal carelessness of the small country towns in the matter of the water supplies is always a source of great wonder, inasmuch as it costs very much less to provide for the proper collection and disposal of the human excreta and to maintain a pure water supply than it does to cope with the disease after an epidemic has developed.

THE PREVENTION OF TYPHOID FEVER. There has been so much written about the prevention of typhoid fever that one hesitates to add to the subject unless it is something distinctly new. Yet one can not pass over the article by Jordan,<sup>1</sup> which is one of a series of papers on Public Health, prepared at the request of the Council on Health and Public Instruction, and reprinted for distribution to the public. He gives the following rules for prevention:

1. Keep away from all known or suspected cases of typhoid.
2. Wash hands thoroughly before meals. Do not use "roller towels."
3. Use drinking-water only from sources known to be pure, or if not possible, use water that has been purified by municipal filtration or by hypochlorite treatment or by boiling in the household.
4. Avoid bathing in polluted water.
5. Use pasteurized or boiled, instead of raw milk.

<sup>1</sup> Journal of American Medical Association, June 6, 1914, p. 1772.

6. Select and clean vegetables and berries, that are to be eaten raw, with the greatest care.

7. Avoid eating "fat" raw oysters and, in general, oysters and other shell-fish whose origin is not known.

8. Be vaccinated against typhoid in all cases in which any special exposure is known or feared.

For the Community:

1. Insist on the hearty coöperation of all persons with an efficient health officer.

2. Require notification and a reasonable degree of isolation of every known or suspected typhoid case.

3. Exercise strict control over the disinfection of known typhoid excreta.

4. Insist on pure or purified water-supplies.

5. Require pasteurization of milk-supplies.

6. Regard all human excreta as possibly dangerous, and control their disposition in such a way as to prevent contamination of food or drink.

All of these rules are undoubtedly good, but one will at once realize that even if one stays at home and is much more discrete than the average citizen generally is, that it is not always possible (even with the rich) to be sure of the source of their drinking water and their milk, and also the source of their vegetables and berries, and everyone would have to give up the use of shell fish as it is exceptional that the ultimate consumer knows anything about the origin of oysters or other shell-fish that he consumes. For this reason, it would seem that rule 8 might be placed at the head of the list, and be extended not only to individuals who have reason to believe that they have been exposed to typhoid fever but made to apply to all individuals. While one does not wish to minimize the necessity of taking every precaution against taking the infection there can be no doubt that the greatest factor at the present time, in the prevention of typhoid fever is the use of vaccine which has been proven to be efficient and without danger.

A SKIN REACTION INDICATIVE OF IMMUNITY AGAINST TYPHOID FEVER. Gay and Force<sup>1</sup> have made some experiments on this subject, using a preparation of typhoid bacillus for which they suggest the name of "typhoidin" which is in all respects similar to Koch's old tuberculin. Using this by the Von Pirquet method, it gives a clear-cut cutaneous reaction in 95 per cent. of the cases that have recovered from typhoid fever. Twenty-one cases were tested altogether, of which 20 were positive and 2 of the cases had suffered forty-one and thirty-one years before. They also tested 41 cases in which the history was negative, and found that 85 per cent. gave no reaction. Fifteen individuals who

<sup>1</sup> Archives of Internal Medicine, March 15, 1914, p. 471.

had been vaccinated by the army method, from four and three-fourths years to eight months previously, gave a positive skin reaction in 9. Twenty-five individuals vaccinated by the Gay-Claypole vaccine for from one to eight months previously gave uniformly a positive reaction. This field of study may eventually prove of great practical value in determining whether or not an individual who has been vaccinated against typhoid requires another series of injections. Gay and Force suggest that individuals who fail to give a positive skin reaction, at any time subsequent to a month after vaccination, have the inoculations repeated.

**TYPHOID IMMUNIZATION.** Gay and Claypool<sup>1</sup> have contributed an article on the subject of *typhoidin*. Incidentally, the history of typhoid immunization is one of the most interesting chapters in modern medicine. As early as 1887, Peiper and Beumer found that mice who had recovered from the infection of living typhoid bacilli were often protected against a subsequent dose, which would ordinarily have proved fatal. They also found that the best result could be obtained by increasing the dosage in successive inoculations, and they suggested that by the use of sterilized cultures, immunity could be obtained. Just about this time, Salmon and Smith, experimenting in hog cholera, and Roux and Chamberlain with malignant edema, found that they could protect certain animals against these infections. Following these, Chantemesse and Widal, using similar methods, found that they could protect mice against the infection with typhoid by using sterilized cultures of the bacillus. Some eight years elapsed when Wright, in 1896, made a preliminary report on this method as applied to human beings, and the following year, in connection with Semple, he published his method in full. He introduced the method of counting the bacteria by comparing their number in a given dilution when mixed with a suspension of red-blood cells, and for his vaccine he used typhoid bacilli that had been grown in bouillon for two or three weeks, and then killed by heat.

Since that time, some twenty different methods have been described, about twelve of which have been put into actual practice. The various preparations of typhoid bacilli that have been used as vaccines consist first of those made from killed cultures of the typhoid bacillus, and Wright, as just noted, used a bouillon culture, and Pfeiffer and Kolle one made of a suspension of agar cultures. These two methods have been modified, Loeffler using dried bacilli, and Friedberger and Moreschi have used a similar dried vaccine, administered intravenously in very small doses.

Various methods other than heat have been suggested in order to kill the bacilli, Vincent using ether; Levy and Bruch have shaken the organisms in a galactose solution, and even the ultra violet rays

<sup>1</sup> Archives of Internal Medicine, November 15, 1914, p. 671.

have been suggested among numerous other methods. Other observers have attempted to abstract the toxic substances from the typhoid bacilli, Hahn, by pressure, and Neisser and Shiga by autolysis of bacteria at body temperature in salt solution, and various other extracts have been made by using distilled water and by dilute hydrochloric acid.

Various observers have tried the use of living cultures, particularly Castellani, Pescarolo and Quadroni. One of the most important modifications has been suggested by Metchnikoff and Besredka in using sensitized typhoid bacilli, in which the organisms are mixed with an immune serum. The original suggestion was to use these alive, but, as a matter of fact, they have generally been killed before the injection is made. Some of the practical results of these methods are noted in the abstract of Boinet's article given below.

Gay and Claypool recommend a vaccination at short intervals with a milder vaccine, and they believe that this may be made to advantage from various strains of typhoid bacilli, isolated in the vicinity of the cases to be treated. Their vaccine, typhoidin, consists of three injections of the sediment of a dried, ground, sensitized culture of several trains of typhoid bacilli mixed together. These injections they recommend at intervals of two days in a dosage of  $\frac{3}{2}$  mg. which has been determined to correspond approximately to 750 million living typhoid bacilli. For cutaneous tests, they recommend the use of dried alcohol precipitate from the typhoidin solution, as the original solution deteriorates in a few months. Whether this method is of more value than the methods of Metchnikoff and Besredka, remains to be seen.

ANTI-TYPHOID VACCINATION IN THE ARMY IN 1913. Russell<sup>1</sup> has contributed another article upon the subject of anti-typhoid vaccination the results of which are common knowledge at this time, but a brief statement of the facts in the case will be found interesting. Three charts are reproduced here which tell the full story. They all deal with the enlisted men. The first shows the admission rates for typhoid fever, the second the death rates, and the third the non-effective rates.

There were no bad effects from the prophylactic injections, and the only changes that have taken place in the health of the army, in which the conditions were not as good as they were in previous years, are very trifling, and practically negligible, increases in certain diseases. These changes are so slight as to have no significance, and there is no reason for believing that the anti-typhoid vaccination is in any way responsible for the differences in the figures. In most instances the difference is much less than 1 per cent. Coincident with the lowering of the rate for typhoid fever, we find a decrease for tuberculosis of all kinds of 4.51 per thousand for the decennial period ending 1911, to 3.49 per cent. for the year 1912, or a decrease of 22 per cent. This bears out the state-

<sup>1</sup> Journal of American Medical Association, May 2, 1914, p. 1372

ment made by Mills and Reincke that if the death rate for any infectious disease be reduced, there will be reductions in some of the other diseases.

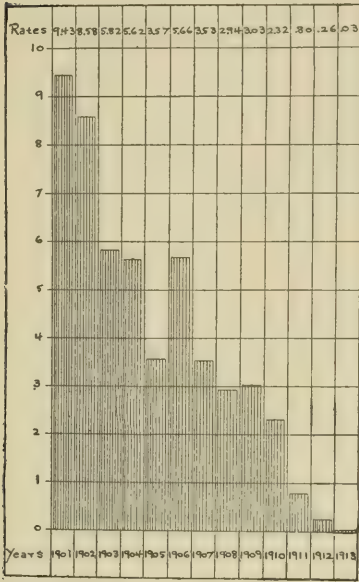


FIG. 7.—Admission rates for typhoid fever, United States (enlisted men).

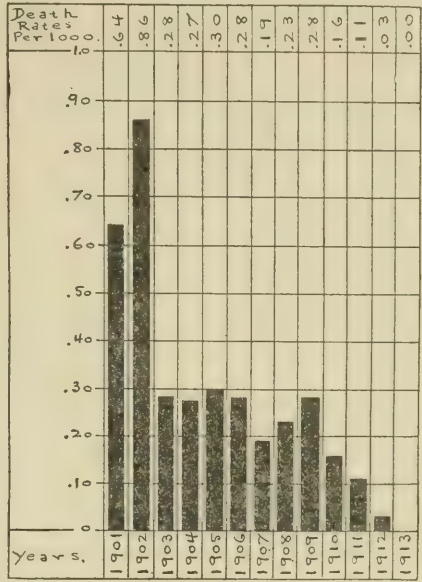


FIG. 8.—Death rates for typhoid fever, United States (enlisted men).

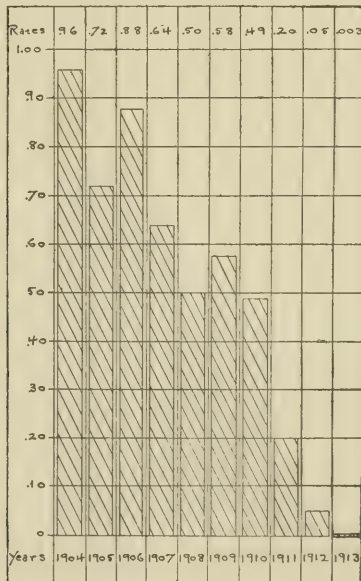


FIG. 9.—Non-effective rates for typhoid fever, United States (enlisted men).

This reduction in tuberculosis is doubtless due to improved sanitation and to the care used in the examination of the recruits.

**TYPHOID VACCINATION IN CHILDHOOD.** One is frequently asked concerning the question of vaccination for typhoid as regards early life, and an article of considerable interest has been contributed upon this subject by Russell.<sup>1</sup> His observations are based largely upon statistics collected in army posts, and in the families of army officers. While he, unfortunately, does not give his figures, he states that less than 2 per cent. of children show a temperature reaction of 103° F., or more. As a rule, the reactions were so slight that the children did not have to remain at home from school or indoors. Sometimes, it was found that the child had a slight temperature without showing any signs of it.

There seems to be no question whatever that the child may be vaccinated as safely as the grown person, and as surely. The dosage should be regulated according to the weight of the child, and slightly more than the proportion may be used. For example, if a child weighs one-third the average weight of an adult, say 150 to 160 pounds, slightly over one-third of the adult dose of vaccine may be given. The child should be revaccinated in case it gains very rapidly in weight, and, as a rule, the vaccinations should be performed more frequently than in grown people, but on this point we have no very definite information as yet. A child who is seriously ill from any disease should not be given the vaccine, but trivial ailments may be disregarded.

In Russell's cases there have been no harmful effects, and no cases of typhoid were reported among those vaccinated, though there can be no doubt that many of the children had been exposed to the disease. He suggests that, for a working rule for the present, it is well to give the vaccination once in infancy, once in childhood, once in youth, and once in adult life. This ought to give a good immunity, and future experience will test the necessity of this number of vaccinations.

It should be borne in mind that the injection should be made subcutaneously, not deep into the muscles, as slow absorption is rather to be desired, and if the injections are made deep into the muscles the absorption is more rapid, so rapid as to be liable to produce severe reactions.

There has been a fear expressed that the typhoid vaccination may have some influence upon stirring up preëxisting tuberculosis. This does not seem to be the case, and in army experience it has been found that the steady decrease of the number of cases of tuberculosis has been maintained, and, as a matter of fact, the decrease has been more rapid since the introduction of compulsory typhoid vaccination. This is not due, of course, to the typhoid vaccination but to the more careful

<sup>1</sup> New York State Journal of Medicine, July 14, 1914, p. 346.

attention paid to the examination of recruits, and to the improved sanitary conditions.

THE TREATMENT OF TYPHOID FEVER WITH VACCINES. There have been a considerable number of contributions made on this subject, and heretofore, the results, while perhaps not negative, have not been particularly satisfactory. Boinet<sup>1</sup> has published the results of his studies in 25 cases of the disease, in which he used the sensitized vaccines of Besredka. The treatment was begun as soon as a positive diagnosis was made, by means of the agglutination reaction. The injections consisted of from three to six doses, and in no case was there any local disturbance, or any complication of a general nature that could be attributed to the inoculation. The therapeutic effects of this injection, according to Boinet, are rather striking. After the second or third injection, usually from twenty-four to thirty-six hours later, there is a distinct amelioration of the general condition, with a diminution of the prostration, and of the torpor, and an increased sense of well-being. The temperature is sometimes seen to fall with this bettering of the general condition, in some instances the fall in the temperature takes place one or more days later. The duration of the disease seems to be definitely shortened, the phase affected being that in which the temperature remains high, and with slight variations. The treatment is employed daily for from four to six days, and the therapeutic action is most marked when the injections are made in the first six or ten days of the disease. In these cases, the course was shortened, the patients were less liable to have complications, and less subject to relapse.

Not only was this method of treatment seen to shorten the disease and lessen its gravity, but it also seems to diminish the extent of the ulcers of Peyer's patches, but hemorrhages from the intestines were not avoided entirely. In 5 of the cases treated, there was a very short recrudescence of the temperature, possibly due to imprudence in diet. Four of the cases died, 1 from an intestinal perforation at twenty-nine days after the onset, 1 from peritonitis fifty-six days after the onset, 1 from septic pyemia fifty-seven days after the onset. In 2 of these cases, the case of perforation, and the case of peritonitis, the treatment was begun a month later, that is, on the sixteenth and twenty-third days respectively. In the septic case, death was evidently due to an abscess formed after the injection of spartein and camphorated oil. In the case of typhoid toxemia, the case was one of extreme severity. Three injections were given, on the tenth, eleventh, and twelfth days, and, following the last injection, there was a fall in temperature on the following day, but the temperature subsequently returned, and the patient succumbed to the disease.

It is interesting to note the duration of the disease in the other cases.

<sup>1</sup> *Annales de l'Institut Pasteur*, May, 1914, p. 540, June, 1914, p. 597.

In 7 of those, the patients were regarded as cured in from twelve to seventeen days, 3 in twenty days, and 4 on the twenty-first and twenty-fourth days. It will thus be seen that in 14 cases the disease was somewhat shortened, and that it was markedly so in 10 cases. The other cases lasted, 2 for twenty-nine days, 4 for thirty to thirty-seven days, and 4 from forty to forty-nine days. In 5 cases, there was some local reaction, and this has usually been regarded as a favorable sign, but while 3 of the cases in which it occurred were cured earlier, it was observed in 2 fatal cases.

The effects of the injection upon the temperature, as shown in the charts which are reproduced, are quite striking. These results seem to be decidedly better than have been obtained by other methods, and it seems probable that with the introduction of some method permitting of an earlier diagnosis still better results will be obtained.

**THE USE OF EMETINE IN INTESTINAL HEMORRHAGES IN TYPHOID FEVER.** Various foreign physicians<sup>1</sup> suggested the use of emetine for the treatment of intestinal hemorrhages in the course of typhoid fever. Among these names are Ardin-Delteil and Gardon, who have published several cases in which, after extensive hemorrhages, there was immediate cessation of the bleeding after the administration of the drug. The use of this was suggested by the experience of other physicians in dealing with hemorrhages due to other causes, especially in the work of Renou, in hemorrhages of the stomach and intestines coming on in the course of cirrhosis of the liver.

Gardon used a solution of 4 c.g. of hydrochloride of emetine in 1 c.c. of water. This was injected under the skin and was followed by a complete cessation of the hemorrhage within twenty-four hours; none of the cases was attended by any untoward symptoms. Flandin has published at least one case of hemorrhage in the course of typhoid fever in which emetine produced no effect whatever. In this connection it is interesting to note the experience of Valassopoulo who used the drug in a woman, aged twenty-eight years, who had complained of alternating attacks of constipation and diarrhea with bloody stools. A single hypodermatic injection with emetine caused the cessation of the hemorrhage and it was afterward found that the bleeding was due to a tumor involving the intestine.

**RUPTURE OF THE SPLEEN IN TYPHOID FEVER.** This is a very unusual complication of typhoid which has been recently studied by Conner and Downes.<sup>2</sup> In addition to their patient, they found 12 other cases recorded in the literature. In 9 of these, the rupture of the spleen was described at autopsies, while in the other 3 it was found in the course of operation done for supposed intestinal perforation. All of these 12 cases proved fatal.

<sup>1</sup> *La Clinica Moderna*, May 14, 1914, p. 278.

<sup>2</sup> *American Journal of the Medical Sciences*, March, 1914, p. 332.

The case reported was in a physician, aged thirty-six years, who was admitted to the hospital with symptoms that had begun seven days before. On the following day he complained of a sudden, sharp, stabbing pain in the hypochondrium. This was soon followed by a severe aching pain in the left shoulder which radiated somewhat down to the left arm. Soon after the onset of the pain, he vomited a small quantity of clear fluid, and broke into a profuse perspiration. The pain was so severe as to require the injection of morphine. The respiration was rapid and shallow; there was marked tenderness to pressure just below the ribs, where the spleen could be distinctly felt, and there was slight rigidity in the upper part of the left rectus muscle. These symptoms came on late in the evening, and in the morning the patient was in a very serious condition. His eyes were sunken, features drawn and anxious, and respiration shallow and hurried. The area of splenic dulness seemed somewhat larger than on admission, but elsewhere the abdomen was soft and showed no tenderness. The base of the left chest posteriorly to the respiratory murmur was feeble, and there was distinct sound both on inspiration and expiration. The patient passed the next night restlessly and was slightly delirious at times, but the following day his general condition was much improved and he was able to take and retain a fair amount of liquid food. The pain in the left side had ceased to be troublesome, but there was still slight tenderness in the upper part. On the third day the condition was better and the appearance was one of a normal typhoid although the Widal test was still negative. Blood cultures showed the presence of an organism resembling the typhoid bacillus, and this was later identified as such. The next day, after a severe attack of coughing, the patient complained of the same severe pain on the left hypochondrium and in the left shoulder. This pain continued throughout the morning and he had, to a very marked degree, the same appearance that he had had during the first attack of pain; small rapid pulse, rapid respiration, a cold sweat, and weakness and nausea. There was dulness on percussion over the left side of the abdomen and some rigidity and tenderness in the upper left quadrant. The rest of the abdomen was soft, and, while having a somewhat boggy feel, was not tender.

The diagnosis of rupture of the spleen was made. The symptoms pointed to a very large loss of blood, but the blood examination showed red cells, 5,280,000; hemoglobin, 85 per cent.; leukocytes, 35,000. In spite of these blood findings, an exploratory operation was decided upon, and a tremendous quantity of fresh clotted blood was found in the abdomen. The vessels of the spleen were ligated and the spleen removed. There was a rent in the capsule fully three inches in length. The patient made what might be regarded as an uneventful recovery and five weeks later was able to leave the hospital, having regained his lost weight and seemed to be in about his usual health. The spleen

showed a layer of old clot lying directly over the dorsum. It seems certain that the acute symptoms which occurred three days before the operation indicated rupture of the capsule of the spleen. It seems very probable that this first rupture was followed by a spontaneous cessation of the bleeding due to clotting of the blood, and that the capsule was again torn three days later.

The symptoms of rupture of the spleen come under two headings, those caused by the severe internal hemorrhage and those caused by the rupture and irritation of the peritoneum. Pain has generally been the first symptom, and there has usually been some tenderness and muscular rigidity in the left upper quadrant of the abdomen, the general symptoms being collapse, pallor, rapid pulse, falling temperature, etc., but in one case, instead of a falling temperature, there was a rise to 106°. The diagnosis of rupture of the spleen in the course of typhoid fever will ordinarily be difficult as the patient is apt to be otherwise in a very serious condition, but the case just reported shows that it is possible. If the diagnosis is made or even suspected, it would seem that the greatest chance of recovery is by immediate operation. Conner and Downes suggest, when the condition is suspected, to make a small exploratory incision under anesthesia, and, if rupture is found, a general anesthetic may be used and the spleen removed.

**The Prevention of Typhus Fever.** I have noted, in time past, the various studies undertaken with the view of determining how typhus fever is transmitted. The first experiments of value are those of Nicolle, Comte and Conseil, who, in 1909, reported that they were able to transmit the disease from one monkey to another by having a body-louse feed on the infected monkey and then upon the one to whom it was to be transmitted. Independently, Anderson and Goldberger, two months later, reported their experiments with tabardillo or Mexican typhus. They had one result which has been regarded as positive, their procedure being the same as the French observers. Subsequently Ricketts and Wilder were also able to transmit Mexican typhus by means of the body-louse and they have succeeded in transmitting the disease from man to monkey and from monkey to monkey. In 1912, Anderson and Goldberger were able to transmit the Mexican typhus and that form of typhus seen in New York by means of infected lice. More recently, Sergeant, Foley and Vialatte<sup>1</sup> have reported their successful transmission of typhus fever to man and to the monkey by means of the body-louse and possibly from the eggs of infected lice. In all the previous experiments, the question of transmitting the disease from man to monkey and from monkey to monkey was studied.

In the work just mentioned, the disease was transmitted to human beings; the authors, and other individuals who volunteered, were allowed

<sup>1</sup> Comptes rendus Academie de Science, March 30, 1914, p. 964.

to be bitten by the body-lice infected with typhus. One of the subjects developed typhus fever in fourteen days after the first bite. Lice that had bitten this individual were used to inoculate a monkey who developed typhus after four days, and blood from this animal produced the disease in another monkey after the incubation period of seven days. They also believe that the eggs from infected lice will produce the typhus fever in man when inoculated through slight scarifying of the skin. It is also possible, as shown by Anderson and Goldberger, that the head-lice may transmit the disease. It will be remembered that in this country, two of the most brilliant investigators who developed the disease while making investigation, died therefrom. These were Ricketts and Goldberger.

This knowledge ought to make it possible to take measures to prevent typhus fever. Joseph Goldberger<sup>1</sup> has made a brief note concerning this. It may be assumed that in the case of typhus fever and the absence of lice, there was no danger in transmitting the disease to other individuals. The question of getting rid of the lice, particularly the body-lice, is rather a large problem and particularly in the southern cities, and in Mexico where a large proportion of the population harbor this vermin. Avoiding coming in contact with crowds in public places is one way, but this is not always possible. The introduction of public bath houses and wash houses will probably have some effect upon lessening the disease; and when the disease is present, special attention to lodging houses, night shelters, jails and prisons will probably go a great way to eradicate the disease. Furnishing provisions where clothes of individuals may be scalded or boiled, and also for cleansing up the individual himself, may help to prevent the disease in armies and the above mentioned institutions. Special supervision in the admissions to institutions should be insisted upon.

The patient who has developed the disease should be removed to clean surroundings and should be thoroughly bathed and treated with some insecticide, either coal oil or tincture of larkspur, and furnished clean clothing. Individuals who have been exposed to the disease should be kept under observation for at least fourteen days and special efforts should be made to free them and also their dwellings from lice. Quarters that have been occupied should be fumigated with sulphur.

**Smallpox and Vaccination in Germany.** Germany has furnished much information concerning smallpox and vaccination owing to the reliable statistics and efficient vaccination laws. It is interesting to note the occurrence of the disease in the German Empire.<sup>2</sup> The Department of Medical Statistics of the Imperial Health Office of Germany state that during 1910, there were 236 cases of the disease, of which 34, or 14.41 per cent. died. Nearly one-half of the cases,

<sup>1</sup> Public Health Reports, May 1, 1914, No. 187.

<sup>2</sup> Jones, Public Health Reports, January 23, 1914.

namely, 105, occurred among foreigners, chiefly Russians; including all cases, there were 3.66 to each million inhabitants; excluding foreign cases, only 2.03. Most of the cases occurred in Russians and seemed to be due to the movement of the foreign laborers who come from Russia and Poland for the season's work. The chief interest centres around the vaccination history of those individuals and the course of the disease. The vaccination status of those attacked and the severity of the disease are shown in the following table:

Vaccination status.	Course.	Age (in years).									
		1	2	3 to 10	11 to 20	21 to 30	31 to 40	41 to 50	51 to 60	More than 60	Totals
Unvaccinated . .	Died . . . . .	4	1	1	5	2	..	..	..	..	13
	Severe or medium	2	1	2	12	2	..	..	..	..	19
	Light . . . . .	3	..	5	2	..	..	..	..	..	10
	No data . . . . .	..	1	..	1	..	..	..	..	..	2
Unknown. . . . .	Died . . . . .	..	..	..	..	1	..	..	..	1	2
	Severe or medium	..	..	..	..	1	..	..	..	1	1
Vaccinated without result . . . .	Died . . . . .	..	..	2	3	..	..	..	..	..	5
	Severe or medium	..	..	2	3	..	..	..	1	..	1
Vaccinated too late	Light . . . . .	..	..	..	1	1	..	..	1	..	3
	Died . . . . .	..	..	..	1	1	..	..	1	..	5
Vaccinated once .	Severe or medium	1	1	1	3	..	..	..	..	..	3
	Light . . . . .	1	1	1	1	..	..	..	..	2	5
Vaccinated once .	Died . . . . .	..	1	1	1	..	..	..	2	1	5
	Severe or medium	..	..	2	4	2	2	..	2	1	13
Revaccinated too late	Light . . . . .	..	2	13	10	6	4	..	3	1	39
	Died . . . . .	..	..	..	..	..	..	..	1	2	3
Revaccinated too late	Severe or medium	..	..	..	1	4	..	..	..	2	7
	Light . . . . .	..	..	4	5	1	2	..	..	2	14
Revaccinated . . .	No data . . . . .	..	..	1	1	..	..	..	..	..	2
	Died . . . . .	..	..	..	2	..	2	..	2	1	7
Revaccinated . . .	Severe or medium	..	..	..	1	2	3	3	2	4	15
	Light . . . . .	..	..	..	7	12	22	14	8	1	64
Revaccinated . . .	No data . . . . .	..	..	..	..	1	..	1	..	..	2
	Died . . . . .	..	..	..	..	..	..	..	..	..	..
Total . . . . .	. . . . .	11	8	31	60	35	35	18	20	18	236

The vaccination status of those attacked and the severity of the disease are shown in the following table:

Vaccination status of persons attacked.	No.	Deaths.	Fatality.	Course of the disease.				
				Severe or medium.		Light.		Not known.
				No.	Per cent.	No.	Per cent.	
Unvaccinated . . . . .	44	13	Per cent. 29.5	19	43.2	10	22.7	2
Vaccinated without result . . . . .	7	1	14.3	5	71.4	1	14.3	..
Vaccinated too late . . . . .	11	3	27.3	5	45.5	3	27.3	..
Vaccinated once . . . . .	57	5	8.8	13	22.8	39	68.4	..
Revaccinated too late . . . . .	26	3	11.5	7	26.9	14	53.8	2
Revaccinated . . . . .	88	7	8.0	15	17.0	64	72.7	2
Vaccination status unknown . . . . .	3	2	66.7	1	33.3	..	..	..
Total . . . . .	236	34	14.4	65	27.5	131	55.5	6

VACCINATION AND SMALLPOX IN AMERICA. In June, 1912, the Conference of State and Territorial Health with the Public Health Service<sup>1</sup> began reporting the vaccination histories of persons developing

<sup>1</sup> Public Health Reports, October 2, 1914, No. 40, p. 2662.

smallpox in their respective jurisdictions. In Minnesota, they began in the month of June, 1912, and in other States at various dates thereafter. In California, of 42 cases, 2 had been vaccinated more than seven years preceding the attack; 22 had never been vaccinated, and the histories were not obtained, but are uncertain in 20. About the same average is obtained in something over 100 cases, chiefly from Ohio.

State and year.	Cases reported.	Vaccination history of cases.				Remarks.
		Vaccinated within 7 years preceding attack.	Last vaccinated more than 7 years preceding attack.	Never successfully vaccinated.	History not obtained or uncertain.	
1912.						
Massachusetts . .	37	1	1	23	12	October, November, December.
Minnesota . . .	1,066	25	76	775	190	7 months, June to December.
Montana . . .	20	....	....	4	16	November only.
New York . . .	372	....	29	204	139	October, November, December.
1913.						
California . . .	662	24	36	419	183	10 months, March to December.
Maryland (exclusive of Baltimore) .	103	....	6	97	....	Except May and July.
Massachusetts . .	152	23	16	76	37	Except July.
Michigan . . .	1,478	15	55	1,114	294	
Minnesota . . .	2,861	47	201	2,255	358	
New York . . .	737	22	94	432	189	Except June.
Ohio . . .	1,782	10	21	763	988	Except February, March, April, and May.
Vermont . . .	34	....	1	9	24	January only.
Wisconsin . . .	2,054	160	195	520	1,179	
1914 (to June 30).						
California . . .	537	14	39	293	191	
District of Columbia	27	4	3	20	....	March only.
Maryland (exclusive of Baltimore) .	190	....	2	188	....	
Massachusetts . .	25	1	4	19	1	
Michigan . . .	928	3	31	768	126	
Minnesota . . .	1,246	13	77	895	261	
New York . . .	721	38	32	548	103	
Ohio . . .	3,462	8	40	1,183	2,131	
Wisconsin . . .	2,341	132	145	631	1,433	
Total . .	20,835	540	1,104	11,236	7,955	

It will be noted that, in over 20,000 cases, something over half had never been successfully vaccinated; whereas the history was not obtained or was not certain in about 80 per cent. of the remainder. Five hundred and forty had been vaccinated within seven years preceding the attack, while 1104 had been last vaccinated more than seven years preceding the attack. It may be assumed that the individuals in whom no history could be obtained, or in which it was uncertain, had not been vaccinated successfully, or certainly only a very small proportion, so that they may be classed as unvaccinated. This means that a very large proportion of the patients had never been vaccinated. In those

who had been vaccinated, particularly those in whom it had been carried out within seven years, one feels that the vaccination was either not properly done, or the lymph used was inert. This is an argument for more careful supervision of the lymph used and more careful methods in vaccinating. It is interesting to compare the figures given above dealing with vaccination in the German Empire. The vast difference in the number of vaccinated individuals is due to the compulsory vaccination carried on through Germany, which consists in vaccination once within a year after birth, and re-vaccination about puberty. Most of the smallpox occurring in Germany is in individuals coming from other countries. Part of the failure to vaccinate in the United States is due to carelessness, and part is due to the opposition to the procedure largely brought about by the propaganda of the anti-vaccinationists. In this connection a paragraph from a lay sermon by Osler, entitled "Man's Redemption of Man" delivered before the students of Edinburgh University will be found interesting.

"Here I would like to say a word or two upon one of the most terrible of all acute infections, the one of which we first learned the control through the work of Jenner. A great deal of literature has been distributed casting discredit upon the value of vaccination in the prevention of smallpox. I do not see how anyone who has gone through epidemics as I have, or who is familiar with the history of the subject, and who has any capacity left for clear judgment, can doubt its value. Some months ago I was twitted by the editor of the *Journal of the Anti-Vaccination League* for maintaining a curious silence on this subject. I would like to issue a Mount Carmel-like challenge to any ten unvaccinated priests of Baal. I will take ten selected vaccinated persons and help in the next severe epidemic, with ten selected unvaccinated persons (as available). I should choose three members of Parliament, three anti-vaccination doctors, if they could be found, and four anti-vaccination propagandists. And I will make them this promise—neither to jeer nor to jibe when they catch the disease, but to look after them as brothers, and for the three or four who are certain to die, I will try to arrange the funerals with all the pomp and ceremony of all anti-vaccination demonstration."

THE CULTIVATION OF VACCINE VIRUS. In spite of the fact that the nature of vaccine virus has attracted skilful and persistent investigation, certain new facts have been added from time to time concerning it, and among these may be mentioned the work of Steinhardt and Lambert.<sup>1</sup> Their studies have been made by using the method suggested by Harrison for cultivating tissue *in vitro*. Similar studies have been made by the same authors in rabies, vaccinia, and syphilis.

In 1913, they showed that there was a definite multiplication of

<sup>1</sup> *Journal of Infectious Diseases*, 1914, p. 87.

virus in tissue cultures composed of the blood plasma and pieces of cornea from rabbits or guinea-pigs, to which small quantities of diluted virus was added. Successful inoculation was obtained from the third subculture. Histological studies of the growth did not reveal any specific vaccine bodies. They have shown that there is a definite increase in the amount of virus present in the cultures; by using dilutions of this, and inoculating it into rabbits, they are able to determine the relative virulence of the various specimens tested.

The theory of multiplication in these cultures cannot, however, be compared to the rapid growth which took place in the cultures of ordinary bacteria. It was found that in order to obtain a growth, it was necessary to use live corneal tissue, and that there was no growth where the cornea was previously killed, either by freezing it, or by subjecting it to hypotonic salt solution. When other organs were substituted for the cornea, such as pieces of the heart, liver, or kidneys, no growth resulted. They also found that if the cornea used was not taken from an immune animal, the virus was soon rendered inactive.

**TETANUS AND VACCINE VIRUS.** There are few subjects connected with vaccination which have afforded the anti-vaccinationists as much material as that of tetanus. If the experience in the United States be omitted, one could state that tetanus was rare. In 1896, the British Royal Vaccination Commission reported only one case. In recent years, in the United States, there have been a number of small groups of cases, most of which occurred in 1901. From a careful study of these cases, it would seem that the disease developed in the vaccinated person from a subsequent infection with the tetanus bacillus. The tetanus bacillus is not developed either in glycerinated vaccine or in dry points, and in the cases alluded to above, other children who were vaccinated with the same virus as those who developed tetanus, remained perfectly well. In almost all the instances there is a history of other sources of infection; in one instance, the scab had fallen on the ground, and had been replaced, and in another instance the children played in a stable or garden in which manure had been used, and in one instance, the child slept in bed with its father, who was a hostler.

By no means all epidemics of tetanus have followed vaccination, but the fact that the two have been associated is sufficient reason to undertake the most careful study regarding them. This subject is considered in a report made from the Hygienic Laboratory of the United States Public Health Service.<sup>1</sup>

The Hygienic Laboratory for the past twelve years has been examining vaccine virus obtained under the greatest variety of circumstances, and from many sources, but no instance has been found of contamination of virus with tetanus. In order to obtain material to study the behavior

<sup>1</sup> Public Health Service Bulletin, August, 1914, No. 95.

of the tetanus spores in vaccine virus, artificial contamination was resorted to, and it was found that not only do the conditions for its growth include freedom from oxygen, but that other elements enter into the question. It was found that most curious differences existed in the symbioses and the oxygen-absorbing properties of the cocci; for example, the presence of staphylococci in the subcutaneous tissue favored the germination of the tetanus spore, while staphylococci in a glucose bouillon inhibited their germination. It was also found that conditions favorable to the growth of tetanus spores in pure culture might be inhibitory to their growth in the next culture. The attempt to recover tetanus bacillus from vaccine virus may be considered an attempt to grow organisms in mixed culture, the organisms being in most cases streptococci, staphylococci, and the *Bacillus coli*, and the *Bacillus welchii*, together with other aërobic and anaërobic bacteria.

In the fermentation tubes, in glucose bouillon, it is almost impossible to produce germination of the spores in the presence of any of the above-mentioned organisms, and the same is true of fresh vaccine virus or of virus glycerinated for months and containing glycerin-resisting anaërobes. The reason for the non-germination of the tetanus spores under these conditions is the early production of a high degree of acidity in the culture medium.

The plan of determining the presence of tetanus spores in vaccine virus by the Public Health Service consists of four methods:

1. By planting the virus in fermentation tubes of glucose bouillon, and incubating immediately.
2. By planting the virus in fermentation tubes of glucose bouillon and heating at 8° C. for an hour before incubation.
3. By planting the virus in fermentation tubes of ordinary bouillon.
4. By inoculating it subcutaneously into guinea-pigs.

No one of these four methods is suitable for determining the presence of tetanus spores in all samples of vaccine virus. Two methods, however, are usually safe for a single sample of virus. One interesting fact was brought out which is that tetanus spores in pure culture, which is free from tetanus toxin, when injected subcutaneously into guinea-pigs and white mice do not give rise to tetanus, but lie dormant at the point of infection, awaiting either destruction by the phagocytes, or awakening to activity and toxin-production by the introduction of some foreign body, particularly quinine, or staphylococci.

In guinea-pigs, often after a month, the spores may be active, and in mice after four months. The action of quinine and staphylococci seems to be about equal in this regard, concerning guinea-pigs, but, in mice, quinine is incapable of activating tetanus spores, while staphylococci will do so with regularity. If, at the time of the injection of tetanus spores into one part of the body of a guinea-pig, there should be injected into another part of his body either quinine or staphylococci,

the animal will usually contract tetanus, and cultures made from the quinine lesions or the staphylococci lesions may be positive for tetanus. This shows that tetanus spores have been transported from the original site of infection and have been planted in the quinine lesion or the staphylococci lesion. This fact may explain the occasional occurrence of tetanus in many persons following a hypodermic injection of quinine.

Among other results may be mentioned the experiments with eight rhesus monkeys, who were vaccinated in five places with highly contaminated virus. They all developed typical vaccine vesicles, but none contracted tetanus. One monkey remained well after tetanus spores had been well rubbed into the vaccination.

**CAUSES OF FAILURE IN COWPOX VACCINATION.** A very interesting article is contributed by Force,<sup>1</sup> and has to deal with the causes of failure in cowpox vaccination. Studies were made upon persons entering the University of California with no evidence of previous vaccinia. All persons entering the University who did not have a vaccination scar were vaccinated, and, if this failed, there was a repetition twice during the first term and once during the succeeding term during the residence at the University. The technique used was uniform in every case, consisting of scrubbing the arm with ether and then scarifying after the manner of von Pirquet which consists of rotary scarification by means of a blunt instrument something like a small chisel. This is done through a drop of virus on the skin. In place of von Pirquet's instrument, the scarification was done with a square cornered dental scaling chisel. This area was covered with a square of gauze applied with four strips of adhesive tape and a printed card of instructions regarding the care of vaccination was given to each person. No antiseptic salves or shields were used. On the tenth day, when the inflammation was at its height, the pain was relieved by a moist application of 50 per cent. alcohol. This inflammation usually subsides in twenty-four hours and, in the absence of large scarified spots, there were no bad arms. The formation of the area around the vaccine vesicle on the tenth day was taken as evidence that the growth of the colonies of vaccinia organisms had been arrested by the antibodies formed by the stimulation due to the organism, or, in other words, that immunity had been established. Before developing this uniform technique, the arms are scarified and dry vaccine points used in place of the glycerinated virus.

The results with the second method are more uniform, there being 95.8 per cent. of all takes, as contrasted with 63.8 per cent. by the old method. The method described has certain distinct advantages. In the first place it is safer and there is less liability to secondary infections, particularly by anaërobic bacteria. This is apt to happen where cross-

<sup>1</sup> Journal of American Medical Association, May 9, 1914, p. 1466.

scarification is used, and it allows a crust to form on the area of abrasion. In Germany, cross-scarification has been forbidden by law on this account. The method is more economical as with 1 c.c. of glycerin virus 285 vaccinations have been performed. There is also an absence of shock if the operation is done rapidly and the person not alarmed. Gradually the technique has been developed in that the chisel used for scarification was supplied with a carbon steel point which could be dipped in alcohol and flamed without destroying the cutting edge. Furthermore, the virus is obtained from the Vaccine Laboratory of the New York Health Department and kept in containers in cracked ice. By attention to the technique and virus, the failures in unscarred persons have been reduced from 21 per cent. to 16 per cent. which leaves open the question of the alleged natural immunity to cowpox vaccination. One should remember that following a vaccination there may be a true, primary vaccinia, or, if the individual has been previously vaccinated, there may be what the French call vaccinoid.

The vaccinia observed five days after vaccination is characterized by a yellowish vesicle surrounded by a narrow red areola, while the vaccinoid of the same age has a comparatively small vesicle surrounded by a wider areola. When no vesicle develops and the areola appears and subsides early, we have what Jenner described as sudden efflorescence and what has subsequently been described by von Pirquet as the immune reaction. Force got the idea that these reactions might be used as the test of those failures which persisted year after year in spite of the best efforts to obtain a take. Observations were made twenty-four, forty-eight, and seventy-two hours after vaccination. In each of these cases two scarifications had been made, one through vaccine virus and the other rubbed with the glycerin diluent in the preparation of the vaccine. If either of the vaccinated spots showed an areola of 5 mm. or over, either with or without a papule, within the end of twenty-four hours, and if this had decreased at the end of seventy-two hours, it was considered a reaction of immunity due to the presence in the blood of the individual of antibodies against vaccine virus. In these cases no further vaccination was performed. If either of the vaccinated spots showed an areola at the end of twenty-four hours, which developed into a small vesicle maturing on the fifth or sixth day and then rapidly subsiding, the reaction was considered a vaccinoid. If there was no change until the third day and then a small areola began to form it was regarded as vaccinia. If no change occurred by the fifth day, the vaccination was repeated.

Out of 589 persons vaccinated, complete records were obtained from all but 2, and in all doubtful cases a re-vaccination had produced one of the characteristic reactions. Three of these individuals were previously unvaccinated and yet gave the reaction of immunity. Of these, one gave the history of smallpox; one had a history of recent

chickenpox which may have been smallpox, and one had had neither smallpox nor chickenpox. The highest percentage of reactions of immunity were in persons having well-pitted scars. Sixteen unscarred old students, and 10 unscarred entrants gave the reaction of immunity. Force explains these by implying the presence of antibodies due to repeated doses of the virus in each instance incapable of growth but capable of producing immunity that is analogous to a vaccine made from a killed culture. By excluding these 26 cases, Force is able to state that no natural immunity against vaccination virus was discovered and he contends that such a person would have no history of vaccinations nor would he give a specific reaction of immunity to vaccine virus. Upon just what he bases the latter part of this statement is not made clear. A point that would seem to be of great practical importance is the suggestion that physician's certificates of immunity should be based on an observed reaction and not on a failure of two or three vaccinations unobserved after the insertion, as the failures may not have been due to immunity but to inert virus.

**Whooping Cough.** HOSPITALS FOR WHOOPING COUGH. In America, whooping cough is regarded with a certain degree of complacency and very little is done to prevent the spread of the disease or to care for patients affected with it. Pisek<sup>1</sup> has called attention to the need of hospital facilities for the care of this class of cases. In 1913, there were 420 deaths in New York. Of these, 49.5 per cent. occurred during the first year of life, 33.4 per cent. between the first and second years, 8.8 per cent. between the second and third years, and 5.2 per cent. between the third and fourth years; after five years, only 1.2 per cent. of the mortality occurred. The number of deaths reported is certainly much too small, as a large number of the fatalities from whooping cough are caused through complications, such as pneumonia, and the death is usually classified under that heading rather than in the predisposing cause.

In New York, there are 1884 beds for infants and children in the public and semi-private hospitals, and 3250 beds in the various hospitals for contagious diseases. Out of all of these, there are only ten set apart at Bellevue for whooping cough with complications, and thirty at the Metropolitan Hospital. Whooping cough is frequently not reported to the Health Department, and many cases are not attended by physicians at all. The difficulty of the diagnosis in the early stages of the disease and the long duration and lack of knowledge as to the exact length of time as to its danger to others, make it an unusually hard problem for any Health Department. A very large number of cases occur among the very poor who are compelled to go to the dispensaries and comparatively little attention is paid to the disease except to

<sup>1</sup> Pediatrics, June, 1914, p. 325.

send the case out of the dispensary as soon as the diagnosis is suspected. Pisek suggests that hospital provisions be made for whooping cough with complications, and also for segregation of others affected with the disease and believes that, as far as New York is concerned, a great deal could be done by using ferry boats and barges for the care of those patients.

**INTUSSUSCEPTION IN THE COURSE OF WHOOPING COUGH.** In the service of Dr. Comby there occurred a rather unusual case which is related by Condat.<sup>1</sup> The patient was a boy, aged four and a half years, who had had whooping cough since the beginning of December, 1913. He was having about ten paroxysms a day, with violent coughing but no vomiting. On the twenty-third of December he had a severe attack, but no diarrhea. During that day he had five stools which were not characterized by anything special, but at the same time there appeared abdominal pain, most marked about the umbilicus and greatly exaggerated by the paroxysms of coughing. On the next day the patient passed clots of blood eight times, and, from the description of the mother, the hemorrhage was very considerable. This time the paroxysms of coughing provoked vomiting, and the abdominal pain had greatly increased. On December 25 there were frequent bloody stools without any fecal material. The patient was very pale and indifferent, the pulse was small and regular, 160; the abdomen somewhat distended but soft, except in the left iliac fossa where there was slight muscular rigidity. In this region the tumor could be felt, and, on opening the abdomen, it was found that there was an extensive invagination of the ascending and transverse colon into the descending colon and the sigmoid. The patient died on the following day. It seems quite probable that the appearance of the intussusception was due to the combination of a diarrhea and the severe paroxysms of whooping cough.

**THE DIAGNOSIS OF WHOOPING COUGH BY THE COMPLEMENT DEVIATION TEST.** In 1906, when Bordet and Gengou first described the bacillus of whooping cough, they controlled their observations with the complement deviation test, and subsequently they have contributed other articles showing that, in the later stages and in atypical cases, it is possible to determine the fact that a disease is or is not pertussis by means of this reaction. Delcourt, and others, have contributed information on this subject, and it would seem that the reaction is not seen early, and that it is only noted toward the period of convalescence or after the patient is cured. This observation of Bordet has been confirmed by Netter and Weil. They found that the test was positive by the end of the second week in the paroxysmal stage. During the catarrhal stage, and during the first week in the paroxysmal stage, they did not find any cases that gave the reaction. Bächer and Menschikoff

<sup>1</sup> Archives de Médecine des Enfants, March, 1914, p. 207.

were unable to obtain any positive reactions in 27 cases which they studied.

It is very interesting, therefore, to note the work of Friedländer and Wagner.<sup>1</sup> They claim, with this method, that it is possible to make a diagnosis in the catarrhal stage or in the first days of the paroxysmal stage. Nine patients examined just at the time when the whoop was starting gave the reaction. They obtained a small amount of blood from the patient's ear, finger or toe, and this was kept at room temperature or placed in an incubator until coagulation had taken place. The serum was then separated more completely in the centrifuge. Only fresh, active serum was used, two drops being necessary for the test. The antigen consisted of pure culture of the Bordet-Gengou bacillus, and it was prepared from seventy-two hour growths in ascitic fluid agar. The colonies were washed off the agar with sterile salt water, an emulsion made, and the bacteria again washed. A standard suspension was made from this and 0.1 and 0.2 c.c. used in the test. In 18 cases in the paroxysmal stage, all showed a positive reaction. Of 3 cases in the catarrhal stage in which the diagnosis was subsequently made by the history, 2 were positive. One case, not whooping but otherwise typical, also gave the reaction. Eight normal individuals were all negative. They call attention to the fact that the antigen used was fresh, and that they have always used perfectly fresh serum. If this method proves to be satisfactory, it will furnish a means of making a diagnosis in disputed cases and will be of particular use in the large children's hospitals as it will enable one to keep out cases of whooping cough. Just how long the reaction lasts after pertussis, will be a matter for subsequent study, but Friedländer and Wagner have not had any cases in which there was a positive reaction unless the patient had had whooping cough within the past four years.

**VACCINES IN WHOOPING COUGH.** Hess<sup>2</sup> has had occasion to study the effect of a series of vaccines used both in the prophylaxis and the treatment of an epidemic of pertussis, which occurred in the Hebrew Infant Asylum in New York.

There were 375 children in the institution, varying in age from a few days to six years. Two hundred and forty-four children were inoculated with four different vaccines, consisting of a typical strain of Bordet-Gengou bacillus together with two atypical strains. The second was a pure culture of bacillus, the third was prepared from four typical cultures, and the fourth was composed of three typical strains isolated from cases included in the epidemic. Twenty of the cases so inoculated developed the disease. Two injections of the vaccine were given in each instance, one of 100,000,000, and the other of 200,000,000. The best results were obtained from the third and fourth vaccines. In

<sup>1</sup> Journal of American Medical Association, March 28, 1914.

<sup>2</sup> Ibid., p. 1007.

24 cases vaccinated with this vaccine, the dose was unusually large, nevertheless one of this group developed the disease. Out of 80 children who were not vaccinated, but who were exposed to the disease, 59 developed pertussis. It would seem, therefore, that the use of pertussis vaccine as a prophylactic might be of considerable value, and its use can be recommended in institutions and also in families to prevent infections.

The use of the vaccine procured by Hess was tried in 65, out of 85 cases of the disease. Of the 20 cases which were most severe in type, only 2 had received prophylactic injections.

The vaccine, as used in the treatment of pertussis, apparently did very little good.

RESEARCHES ON WHOOPING COUGH. Some of the Italian investigators, Pacchioni, Caffarena, Consiglio and Corradi,<sup>1</sup> working in the pediatric clinic of Genova, carried on a series of experiments to determine the pathogenic properties of the bacillus described by Bordet and Gengou in the sputum of children suffering with whooping cough. They isolated the organism and injected it into the peritoneal cavity of young guinea-pigs. This caused the formation of a hemorrhagic exudate and some congestion of the adrenals, followed by death. No effects were obtained in monkeys, but two, out of four, dogs in which cultures of the organism were sprayed into the trachea and the nasal pharynx, showed, nine days later, a convulsive cough very similar to whooping cough and in one of the dogs the attacks of coughing were followed by vomiting. The disease lasted a few days and the autopsies upon the animals showed a reddened larynx and trachea, reddening of the parabronchial lymph nodes which, on microscopic study, were found to be congested, with hemorrhagic spots. The blood of the dogs was sterile, but the Bordet-Gengou bacillus was found in the trachea. The blood of the dog showed a slight leukocytosis due to an increase of the lymphocytes.

PAPAVERIN IN THE TREATMENT OF WHOOPING COUGH. Various Austrian observers have been experimenting with the hydrochloride of papaverin. The results obtained are apparently such as one might obtain with heroin or other drugs of this class, but Hochsinger believes that the intensity of the paroxysms is lessened and that the course of the disease is somewhat shortened. Januscke<sup>2</sup> has obtained remarkably good results in whooping cough and also in asthma. It is practically used in young children. The dosage recommended varies, at ten years of age one-third to one-half grain, 0.02 to 0.03 gm., and is given three to four times a day. Another suggestion is to give 5 grains, 0.32 gm., in a liter of water, and give from a teaspoonful to a dessertspoonful of this at intervals of two hours.

<sup>1</sup> Il Policlinico, Zezione Practica, February, 1914, p. 243.

<sup>2</sup> Therapeutische Monatsschrift, April, 1914.

# DISEASES OF CHILDREN.

By FLOYD M. CRANDALL, M.D.

DURING the past year pediatric writers have covered their particular field more evenly than has been the case for several years. As a rule, some particular subject has been of apparent interest and an excessive amount of writing has been done upon it. This year, however, no subject has received an abnormal amount of attention. Diseases of the newborn infant have usually been a prolific source of study and writing. This year, however, these conditions have received very little consideration. The infectious diseases always occupy considerable space in pediatric journals and text-books. They are considered in this work in a special department.

**Infant Welfare Work** and preventive medicine continue to receive much attention from pediatric practitioners and writers. The best recent article upon this subject perhaps is a prolonged paper by Van Ingen,<sup>1</sup> of New York, who reviews recent progress in welfare work. It is a paper worthy of reading by every person interested in this rapidly expanding subject. The movement has grown up within the past ten years and only for six years have the sporadic and disjointed efforts been coördinated and reduced to anything like adequate system. City, state, and national governments are coöperating with each other and with private associations and the results are surprising. Infant milk stations, welfare stations, and clinics are of very recent development but their value, particularly when coördinated, is proving a surprise even to the most sanguine. Van Ingen devotes much space to the the subject of preventing mortality among infants during the first week of life. The attention given to this brief but highly important period is also of comparatively recent date. A brief account of the various associations for promoting welfare work is of value as well as a description of efforts at coöperation.

No stronger argument for the value of preventive medicine among mothers and babies is to be found than the entrance into the field of a great business corporation, the Metropolitan Life Insurance Company. This company realizes that the prevention of illness means money in its pocket. During the first half of the year 1912, nursing service was provided free to 6374 maternity cases, to whom the nurses paid 6374 visits. Its 11,000 agents distributed the company's booklet, "The Child," to all its policy holders. This little book is now in its third million. A pamphlet on milk and its care is now in press. The nursing

<sup>1</sup> American Journal of Diseases of Children, June, 1914.

service of the company in the first two months of 1914 covered 1700 cities and towns. The company also offers to coöperate with health officers in many ways. In Syracuse, for example, the agents send the local health officer a post card bearing the name and address of every child under one year of age found in the families they are visiting. This is being done as an aid to the department in increasing the registration of births.

**Infant Mortality.** The prevention of infant mortality continues to receive large attention from pediatric writers. Two years ago, I<sup>1</sup> gave extended attention to this subject and to child welfare work. At that time the study of these subjects had begun to reach large proportions. A historical sketch upon infant mortality, ancient and modern, was the subject of the presidential address by Holt<sup>2</sup> before the American Association for the Study and Prevention of Infant Morality at its fourth annual meeting. The importance of saving child life has been a subject of slow development and Holt's tracing of its growth from ancient times is highly interesting and useful to the modern worker.

In seeking for the causes for this awakening many factors must be considered. It has not come about from any one influence, but is the result of many; the motives which have aided in bringing it about have been varied. Some have been stronger in certain countries, while in other lands different influences have been at work. Speaking generally for the world at large, the humanitarian motive has probably been the strongest one. It is a general desire for the betterment of social conditions, which has been the most widely influential. This, no doubt, has been the chief motive in America.

Among the European nations, especially France, it is the economic aspect of infant mortality which has been uppermost. It is surely not an accident that the French have been foremost in their interest in this question and that so many of the organizations or agencies for the reduction of infant mortality have originated with them. For more than two generations they have viewed with apprehension the fact that with a high infant death rate, their birth rate was the lowest in Europe and steadily falling. How to save their infants had become a public question of the first importance. With a smaller loss by emigration than either Germany or England, the population of France in the twenty years from 1891 to 1910 has increased less than a million, while during the same period Germany has increased over fourteen million and England over seven million. Germany has also been greatly stirred over the economic aspect of infant mortality. While her birth rate has been and still is considerably higher than that of France, its fall, especially in the last ten years, has been more rapid.

A third influence has been the progress made in medicine and sanitary

<sup>1</sup> PROGRESSIVE MEDICINE, March, 1913, p. 334.

<sup>2</sup> Archives of Pediatrics, December, 1913.

science and especially the enormous advances made in preventive medicine in the last thirty years, by which it has been shown what was possible in hygiene and public health. Better sewage, pure water, clean milk, cleaner streets, food inspection, attention to ventilation and to all matters of general hygiene, have done much to overcome the unfavorable effects of city life upon the very young.

**The Effect of Heat upon Infant Mortality** has been the subject of several papers. One of the most careful of these is that of Schereschewsky,<sup>1</sup> of the United States Public Health Service. He studies the various causes contributing to the illness of children during the hot months and concludes that the action of heat as a direct cause in the summer mortality of infants has been greatly underestimated in the last twenty-five years. In the future much more weight should be given to its influence. The lethal action of heat is a function, not so much of the maximum and mean temperatures of the external air, as the indoor temperatures, which, in the late summer may continue to be high in spite of remissions in temperature of the external air. The action of dirty and stale milk in the causation of infant death has been given a significance which has overshadowed other factors of equal importance. There is evidence to show that a certain proportion of infant deaths are due to specific infections, in the dissemination of which contact, infection, and flies doubtless play a part. As a result, future activities for the prevention of infant mortality must concentrate themselves to a greater extent on the question of housing, especially the conditions productive of high indoor temperatures, such as overcrowding, narrow streets, and the absence of thorough ventilation. Poor housing conditions can be partially neutralized by the proper care of babies in the summer. The general public should be educated as to the importance of high indoor temperatures in causing the death of infants, and especially as to measures which prevent babies from suffering from the heat. Breast feeding must still be regarded as a most, if not the most, important preventive of the summer death of infants.

Observations upon the relation of heat to infant mortality are reported by Helmholtz,<sup>2</sup> of Chicago, who asserts that infants have a remarkable power of adjusting themselves to high temperatures. According to his observation, when deaths occurred in periods of greatest heat, it was found to be owing to carelessness or ignorance of the mother. It was found that if properly cool clothing was used and proper care was observed, infants can withstand much higher temperatures than is generally supposed.

**Asphyxia Neonatorum.** One of the best papers of the year on this subject is that of Manton,<sup>3</sup> of Detroit. He considers chiefly the etiology

<sup>1</sup> Archives of Pediatrics, December, 1913.

<sup>2</sup> New York Medical Record, July 4, 1914.

<sup>3</sup> New York State Medical Journal, June 14, 1914.

and sequelæ, and adopts the customary division of *livida* and *pallida* as a convenient one. From the appearance of the child, we are enabled to determine, with more or less accuracy, whether we are dealing with a lesser or more serious form of the condition. It should be borne in mind, however, that the prognosis is always uncertain. In *livida*, the cyanosed face and upper thorax, the strongly pulsating cord, the tonicities of the muscles and the presence of the reflexes are signs, as a rule, of a more or less ephemeral condition. But the blue variety may pass into the pale, anemic form, with immediate or near-future exitus. Even resuscitation in such instances does not insure the continuance of life, for a large percentage of these children perish within the first eight days, while from 20 to 30 per cent. die within varying periods thereafter. Poppel estimates that the death rate of asphyxiated children within the first week of life is seven times that of those born normal.

Among the most important and serious manifestations of neonatal asphyxia are those of cerebral pressure, which must be differentiated from those arising from asphyxia of a purely suffocative type. In the latter, the symptoms are usually transitory and give rise to little or no injury to the nervous structures. When death results, autopsy reveals small or punctate hemorrhages into the meninges of the brain and cord, the nervous substance being rarely implicated. Under timely and proper treatment, children survive this state even when it has progressed to the pathological degree just noticed, and it is altogether probable that the minute extravasations become absorbed without leaving trace of the preceding process.

The occurrence of cerebral pressure symptoms, on the other hand, as seen in *livida*, mark a more extensive and serious involvement of the brain structures. In most, if not all, of these cases the manifestations are the result of intracranial hemorrhage of considerable extent. In these children the face and body surface is extremely pale; there is absence of muscle tonus; the extremities are relaxed and external reflex excitability is wanting. The heart's action is extremely feeble and rapid, as a rule, but is sometimes slowed, and respiration, once established, is irregular, spasmodic, and shallow. The pupils are contracted, strabismus may be present, and hemiplegia and convulsions may develop.

In those children in whom the intratracheal hemorrhage is slight at birth but gradually augments during the first hours or days of life the infant may be born apparently healthy, and at first cry lustily. Later, symptoms of cerebral pressure gradually appear; convulsions and paralysis occur; breathing becomes more and more difficult and shallow; and the child finally succumbs. In other instances death may occur suddenly and unexpectedly, without previous notable symptoms. While profound asphyxia neonatorum is a disorder of serious import, it is not often directly responsible for the cerebral paralysis of children

—chiefly perhaps for the reason that infants rarely survive the initial stage of the disorder.

**The Treatment of the Asphyxiation of Newborn Children** is satisfactorily treated by Sakaki.<sup>1</sup> He refers to the fact that an air pump is more powerful when the piston is worked rapidly. He has also observed that when water is poured over a small pipet, air bubbles form and prevent the entrance of water into the pipet. Guided by these facts he has adopted a method of resuscitation having some original features. He holds the child facing him with his forefingers in the axillæ. His thumbs meet at the front of the child's throat and prevent its head dropping too far forward. The other three fingers of each hand are applied to the back of the chest. The child, thus held firmly with its arms flexed and pressed against its side, is shaken gently but rapidly, 120 to 150 times a minute. The air can be heard entering the child's air passages. Then the child is suspended by the feet and the mucus runs out of its mouth and nose. After a few seconds, the whole procedure is repeated. This can be done before the umbilical cord is cut and is an effective way to get air into passages clogged with secretions.

**Tetany.** Under the title of spasmophilia, Reye,<sup>2</sup> of Ann Arbor, presents an extensive article on the disease commonly known as tetany. He describes it as a symptom-complex, depending on hyperirritability of the entire peripheral system. The most characteristic symptoms of manifest spasmophilia are those referable to the motor nerves. They are laryngospasm, eclamptic seizures, and tonic contractions of the extremities. In a typical case the hands are in the obstetrical position, and the arms and legs are rigidly flexed to the body. In severe cases the tonic symptoms also spread to the head and the body, producing then a mask-like expression of the face, contracted mouth, wrinkling of the forehead, episthotonos or emprosthotonos.

On the part of the sympathetic nervous system there is erythemia, urticaria, hyperidrosis, peculiar swellings on the hands and feet, and alimentary disturbances, such as dilatation, cardiospasm, vomiting, and diarrhea. The heart action is usually increased. The hyperirritability of the peripheral nervous system preceding or following manifest spasmophilia is spoken of as latent tetany. Its presence may be determined by the three following signs: (1) Chvostek's sign. This is elicited by pressing or tapping over the trunk of the facial nerve or its divisions, producing lively contractions of the muscles which they innervate. (2) Trousseau's sign is best produced by digital pressure in the occipital groove or by applying an elastic bandage and leaving it on for several minutes. It provokes a typical attack in that limb. This sign is usually considered pathognomonic. (3) Erb's phenomenon, demonstrating

<sup>1</sup> Deutsche mediz. Wochenschrift, April 2, 1914.

<sup>2</sup> Archives of Pediatrics, September, 1914.

directly the increased irritability of the peripheral nervous system by means of the galvanic and faradic currents.

There are many theories regarding the etiology of spasmophilia. In general, however, they may be reduced to the two following groups: (1) Spasmodic diathesis is due to calcium intoxication or to calcium deficiency. (2) Spasmophilia is due to parathyroid insufficiency, which may be the cause of a disturbance of the intermediary metabolism.

According to the oldest theory, formulated by Kassowitz, the symptoms of spasmophilia are the nervous manifestations of rachitis. This opinion is based on the good effect of phosphorus and cod-liver oil in both diseases. Experience has shown that many symptoms of spasmophilia are dependent on the diet. Gregor was the first to ascertain that all the symptoms of the disease, especially the galvanic irritability, stand in a definite relation to the diet. Finkelstein found galvanic hyperirritability in more than one-half of the lower classes. He also noticed that spasms occur especially when babies are put on artificial food and they disappear when put back on the breast, often within a few hours. It has been found that the symptoms of spasmophilia depend also on the quantity of the food; for the richer the diet, the more pronounced the symptoms. They can often be entirely suppressed by cathartics, water, a tea diet, or a complete fast.

Various artificial diets have an influence on spasmophilia. Cow's milk is most dangerous. Sugar, butter, fats in general, have no influence on it. Finkelstein, therefore, thought that some constituent of the diet was the true cause of the nervous irritability and studied the influence of separate constituents of artificial feeding by adding casein of cow's milk, fat and sugar to the mother's milk of the spasmophilic child. However, he obtained no results. But when the whey of cow's milk was added, the irritability again increased just as if the baby had been put upon cow's milk. Therefore, Finkelstein reached the view that the underlying cause of tetany is a special form of disturbance of the intermediary metabolism. Since there is five times as much calcium in cow's milk as in mother's milk, he naturally thought of the influence of calcium. He tested this but obtained no uniform results in the two cases that he worked with.

Stoelzner worked along the same line. He fed the different constituents of the whey of cow's milk to spasmophilic children in order to ascertain the causative agent. He emptied the bowels and gave a milk-free diet in order to produce a normal electrical reaction. He then fed ferrum lacticum, potassium acetate, sodium chloride, sodium phosphate, and magnesia usta, without obtaining any increase in the electrical irritability. From these experiments, Stoelzner concludes that the influence of cow's milk on spasmophilia lies in a calcium intoxication.

Thiemich does not agree with Finkelstein that the noxious effect of the diet on spasmophilic children is to be sought only in cow's milk.

Clinical experience is against this, for spasmophilia sometimes occurs even in breast-fed children. Though these are exceptional cases they prove that the diet is not the only factor involved. Finkelstein himself recognizes this, for he differentiates two groups of children. In the first group he puts the well-nourished, the fat, and the over-fed. In them spasmophilia disappears when the diet is changed or reduced. In the second group he places the thin, emaciated children, who are usually suffering from chronic gastro-intestinal catarrh. In these cases even a strict diet has no effect. Finkelstein also calls attention to the hereditary factor. He suggests that children who develop spasmophilia after the slightest nutritional disturbance are descended from mothers who themselves suffered from spasmophilia in childhood. He finds that some of the mothers actually show evident signs of latent tetany.

In addition to heredity, Thiemich cites other physiologic factors, such as long-continued illnesses which lead to cachexia, disturbance of respiration, and poor ventilation of the blood, rises in temperature, and fever.

From the foregoing it is evident that at present there is no unanimity of opinion. The majority of workers seem to favor the idea that there is a disturbance in the intermediary salt—especially the calcium metabolism which may be due to an insufficient functioning of the parathyroids. Most authors recommend that the spasmophilic infant be put on mother's milk, if possible, or that a wet nurse be secured. In a large number of cases this measure is sufficient to cause disappearance of the symptoms. With children over a year, milk can be dropped for a week without harm. In all cases of spasmophilia, cod-liver oil, or phosphorus and cod-liver oil is indicated. On this alone in many cases without any change in diet, the symptoms disappear. Phosphorus with other oils is ineffectual.

**Exudative Diathesis in Infancy.** A condition was described a few years ago by Czerny, which he called the exudative diathesis. It is similar to the condition which for many years was called scrofula in this country. It has been said that scrofula is the exudative diathesis plus the action of the tubercle bacillus. I<sup>1</sup> discussed this subject at considerable length two years ago, referring to the singular fact that other countries, including France and Great Britain, have been writing less and less of diathesis, while Germany should be the one to rehabilitate the idea. In a recent article, however, H. C. Cameron<sup>2</sup> asserts that the exudative diathesis of Czerny is common in England and is constantly met with in a greater or less degree. In infancy, the most common manifestation shows itself in the complete or relative failure of breast-feeding. The children often show none of the strength, vigor, and firmness of the normal breast-fed infant.

From the first, they may be meagre, small, and complaining, and per-

<sup>1</sup> PROGRESSIVE MEDICINE, March, 1913, p. 254.

<sup>2</sup> British Medical Journal, July 11, 1914.

sistently dyspeptic. The mother's breasts may be well formed and full of milk, and yet for weeks and even months no improvement takes place. Dyspepsia, with the passage of green stools and vomiting, is frequent, and in a breast-fed child should always suggest the existence of this diathesis. In other cases, however, another picture presents itself. The infant achieves a rapid rise in weight, yet the more rapid the growth, the more marked do the other symptoms of the exudative diathesis become. Nasopharyngeal catarrh, with the accumulation of material in the posterior nares and glands, is common. Laryngitis, bronchitis, and otitis media are frequent complications. The mucous membrane of the intestine is also affected. In earliest infancy constipation or dyspeptic green stools, are common symptoms. The spleen, thymus, tonsils, lymphatic glands, and intestinal follicles, all show a tendency to enlargement which is probably secondary to the chronic irritation in the areas which they drain. The symptoms of the diathesis are encouraged or controlled largely by the composition of the diet. Especially marked, as a rule, is the effect of a fat, rich diet, such as cow's milk. Even breast milk may disagree for this reason. Limitation of the amount of milk and the early substitution in part of carbohydrate food, is usually the most successful line of treatment. Without dietetic regulations the local treatment of the various manifestations, the repeated catarrhs, the lymphoid overgrowth, as, for example, the adenoid enlargement—is often without avail.

**Chondrodystrophia Fetalis.** Two cases of this rather rare condition are reported by Young,<sup>1</sup> of Philadelphia. The first represented the hyperplastic type; the second, the hypoplastic. The first is the usual type of chondrodystrophia fetalis, such as is frequently confounded with rickets, but from which it may be distinguished by the x-ray findings. The second case described is a fac-simile of one described by Rotch<sup>2</sup> except that the child reported by Rotch died on the ninth day after birth. This child was still living at the fourteenth week, when reported to the Society.

Chondrodystrophia fetalis, or fetal rickets, is a term used to describe a defect in the formation of the epiphyseal cartilage of the long bones in fetal life, resulting in a form of dwarfism. It is sometimes called achondroplasia. Several forms have been described—hyperplastic chondrodystrophia, with excessive growth of the epiphyses, and hypoplastic chondrodystrophia, with irregular development of the epiphyses and sponginess of the bone, and chondrodystrophia malacia, characterized by softening of the epiphyseal cartilage. The most singular fact in connection with this condition is the occasional occurrence of rickets in the same family after the birth of a child suffering from chondrodystrophia. The cause is unknown. It is only known that malnutrition accompanies the condition and that the majority of patients so

<sup>1</sup> Archives of Pediatrics, May, 1914.

<sup>2</sup> Pediatrics, 1906, fifth edition, p. 331.

severely afflicted die soon after birth. All the changes in the bones are the result of the disturbance in the normal process of ossification.

**Blood-pressure in Children.** A series of observations upon the blood-pressure of normal children was undertaken by Judson and Nicholson<sup>1</sup> in order to determine whether a standard of blood-pressure could be established. Could a standard be made, it would open to the pediatrician a new aid in diagnosis and prognosis, and help in the treatment of a large number of diseases. Blood-pressure readings would also furnish a means of determining the physical tone of a large number of children, who are below par but have no demonstrable pathological lesion. The whole problem depends upon our having an accurate and reliable means of obtaining the readings. After the attainment of a correct technique, a sufficient number of observations should be taken to establish a standard.

The blood-pressure of children, as of adults, depends on four main factors: The contracting force and rate of the heart; the peripheral resistance of the arterioles and capillaries; the elasticity of the vessel walls; and the character of the blood as to volume, viscosity, etc. The contracting force and rate of the heart is the most important factor. Owing to the relatively larger, more elastic, and distensible arterioles and capillaries found in children, the peripheral resistance is less marked than in adults, and the vessel walls are in a less stable state of equilibrium. This simply means that the systolic blood-pressure is a more direct representation of the work of the heart than in the adult. The importance of the vasomotor system must not be overlooked as one of the main factors causing variations in blood-pressure in childhood. The volume and viscosity of the blood are, as a rule, of slight importance.

All blood-pressure determinations are influenced by certain physiological factors. Blood-pressure changes, with alterations in weight and in children of the same age, varies according to height. The influence of the sex is less than in the adult, with slightly higher readings in the males. Emotions cause an increase in the pulse-rate and a consequent elevation in the blood-pressure. Within fifteen or twenty minutes after meals there is a rise and a fall again in three-quarters of an hour to an hour and a half. There is a gradual fall in blood-pressure during sleep. At the end of the day, blood-pressure is higher than in the morning. There is a rise in blood-pressure during exercise, directly in proportion to the muscular effort. During inspiration blood-pressure falls, to rise again during expiration. In healthy children breathing does not exert much influence except during prolonged forced and deep respiration.

A study of *blood-pressure in anemia in infancy*, is reported by Morse and Wyman,<sup>2</sup> of Boston. These observations show that with disturb-

<sup>1</sup> American Journal of Diseases of Children, October, 1914.

<sup>2</sup> Ibid.

ance of nutrition, there is a progressive lowering of the diastolic pressure and a corresponding increase in the pulse pressure. The systolic pressure, on the other hand, rises with the increase of the anemia. These observations merely bring out certain facts, but unfortunately, do not warrant any definite conclusions as to their cause.

**Vulvovaginitis in Children.** This subject has received recent editorial consideration.<sup>1</sup> Outside of children's hospitals this affection has not hitherto received the attention which its importance warrants. It is coming to be recognized as a formidable malady. Epidemics occur not infrequently in children's hospitals, asylums, and other institutions, and it is undoubtedly present among little school girls almost everywhere. On account of its obstinacy it is very troublesome to manage, and Health Commissioner Goldwater, of New York, has made the statement that the questions involved in handling it are among the most difficult and puzzling with which the public administrators have to deal, and that the problem has not yet been solved. While in a few instances the vaginal and labial discharges are due to some catarrhal state depending on the presence of thread worms or the debilitated condition of scrofulous or tuberculous children, in the vast majority the condition is a gonococcic infection; so that, for all practical purposes, the vulvovaginitis may be considered a gonorrhea.

The special points of interest are the sources of infection, the treatment, and, above all, the prevention. A recent communication on this subject is a paper by Taussig,<sup>2</sup> of St. Louis, based on 66 cases. He is convinced that the most frequent source of infection is from child to child, and that the most common manner of transmission is through the school lavatory. In epidemics in children's institutions, the hand of the nurse and the bath may at times be responsible, but Taussig does not believe these are very important factors in sporadic cases; nor does he think that transmission is very common through cloths, either in the form of clothing, towel, wash cloth, or bed linen. Cloth will absorb considerable secretion, and as the gonococcus is particularly susceptible to drying, will in the course of ten to fifteen minutes be dry enough not to be a serious source of infection.

In treatment, Nathaniel Barnett<sup>3</sup> advises the use of the Kelly endoscope. After the excretion has been removed with the applicator, Lugol's solution is applied to the cervix and vaginal walls as the endoscope is slowly withdrawn. These treatments are carried out three times a week, and, in addition, the mother is instructed in the method of giving daily vaginal douches of potassium permanganate solution, one to ten thousand, by means of a soft rubber catheter, introduced as far as possible. Taussig employs 2 per cent., and even 4 per cent. silver nitrate solutions,

<sup>1</sup> New York Medical Journal, October 10, 1914.

<sup>2</sup> American Journal of the Medical Sciences, October, 1914.

<sup>3</sup> Archives of Pediatrics, September, 1914.

the injections being made with the ordinary small rubber-tipped urethral syringe. He has found no record of the use of such strong solutions by others and believes that his favorable results and the absence of any untoward symptoms, justify a further test of this treatment. Rest in bed is recommended in acute cases. Fresh air, good food, and an iron tonic aid materially in effecting a cure.

Extended observations are reported by Sinclair,<sup>1</sup> of Philadelphia. He employed the female urethroscope in 83 infants admitted to the baby's hospital. The treatment consisted of irrigations of potassium permanganate, one to eight thousand, and local applications of argyrol in 20 per cent. solution. When the discharge became scanty, a solution of hydrochloric acid, one to ten thousand, was substituted for the solution of potassium permanganate. Irrigations with both of these solutions were discontinued with the discontinuance of the discharge and were thereafter only employed on days when a discharge was again present.

To be effective, prophylaxis must begin with a campaign of education in the homes where infants are born and raised, as well as in all manner of institutions which have to do with the various phases of child welfare. Day nurseries, infant and orphan asylums, hospitals, shelters, public bath-houses, recreation centres, and school-houses, are prolific sources of infection, and will continue to be, until adequate medical supervision is exercised, and individual cases are isolated until free from the specific organism.

**Diseases of the Heart in Children.** An interesting study upon *causes of diseases of the heart in young children* is reported by Swift,<sup>2</sup> of New York, and is based upon twenty-seven years of experience in St. Mary's Free Hospital for Children. After prolonged study of a series of 1350 children, he believes cardiac and joint disease to be due, in most cases, to acute infections occurring about the nasopharynx (adenoids, ethmoidal cells, tonsils), the gums, and alveolar processes irritated by decaying teeth. Removal of the source of infection and improving the condition of the nasopharynx and gums show marked improvement in the child's condition. The temperature subsides; the joint signs tend to clear up; and, although a heart murmur may persist, other signs of heart disease disappear. His conclusion is that acute cardiac affections are due to germ infections—a sepsis (according to Rosenow the most common infection germ is streptococcus viridins); that the infecting germs are distributed throughout all the structure of the heart; and that the most important feature of treatment is the discovery of the source of infection and its removal.

In a paper upon the peculiar manifestations of heart disease in children and the management of cardiac patients, Crandall<sup>3</sup> reports conclusions

<sup>1</sup> Archives of Pediatrics, January, 1914.

<sup>2</sup> Medical Record, February 21, 1914.

<sup>3</sup> Archives of Pediatrics, September, 1914.

based upon twenty-five years' observation of recorded cases. In the graver forms of heart disease, which come to autopsy, the disease is never limited to the endocardium alone. The pericardium and the myocardium are also involved. A certain amount of degeneration of the fibers of the heart muscle occurs during the course of every acute febrile disease or intoxication. This is frequently mild in degree, but myocarditis with little or no valvular involvement may cause the death of the patient, as in diphtheria. It is difficult to believe that in some of the less severe types, which run a favorable course, any marked degree of myocarditis or pericarditis is present. The probability of myocarditis, however, must never be forgotten. Examinations for its detection should be frequent and careful, for upon it, more than any other element, depends the prognosis and much of the treatment.

Four symptoms are particularly suggestive of muscle involvement. The earliest to appear is irregular heart action or palpitation, and this is usually the most distinctive symptom. Syncope is characteristic of decided myocarditis, particularly in diphtheria. In addition to these two symptoms, cyanosis and precordial distress are very suggestive of muscle involvement. One or more of these symptoms in conjunction with physical signs warrants the belief that in addition to the endocardial disease, we have also muscle involvement. In the later stages the occurrence of cyanosis and edema is of more grave significance in the child than in the adult. A point of great interest is the occasional rapidity of the development of the physical signs of endocarditis. A loud endocardial murmur may fully develop within eighteen hours. It is not always that a soft indefinite murmur precedes the development of distinctive sounds. Recognition of this fact would sometimes have saved criticism of practitioners by others who have been brought into the case. It is quite possible that a distinctive blowing murmur may be present today, that was not present yesterday.

The final course of cardiac disease is always of great moment and interest. The patients in which the disease begins before twelve years, have a very important period before them. The physician who ignores the gravity of a cardiac murmur and lightly says the child will grow out of it, is taking almost a criminal risk. It is quite true that during this period of change some children do materially change for the better. The unfortunate opposite is more frequently the result. Frequently, when a murmur has been left and the myocardium has been in fairly good condition, children go through this critical period without material changes in the cardiac condition. If they go to eighteen or twenty with a reasonably good cardiac muscle, they have a very good chance of going through the next three decades without cardiac symptoms. When the degenerative changes begin to appear, however, in later life the individuals with impaired heart have not the chance possessed by normal subjects. They more readily succumb to acute disease and to

arterial changes, and are not as apt to live to advanced age. The earlier the primary endocarditis occurs, the better the ultimate prognosis, because of the more perfect adaptation of the child to the heart and the heart to the child. They grow up together and are more apt to adapt themselves to each other than they do in later years. An aortic lesion is a very dangerous thing in a child, but aortic insufficiency is fortunately rare in children.

The evil effects of anemia upon the child with cardiac disease can scarcely be overestimated. It is a contributing factor to weakness and fatty degeneration of the heart muscle. If uncorrected, it may be a factor in turning the scale against the child. This is true even of young children, and particularly true of the period after fourteen. The chlorotic type common to girls at that period should be watched for and should be vigorously combatted by diet, moderate outdoor exercise, and medication.

The effect of endocarditis on the growth and development of a child is a question of considerable interest. There are certain ones of the more grave cases, particularly those of decided rheumatic tendency with recurring attacks, which do not develop well. The constitutional tendency of the child and its rheumatic involvement are often factors more important than the heart lesions.

The *treatment of endocarditis* divides itself into two very distinct stages—that of the acute and that of the chronic condition. The importance of absolute rest during the earlier stages is very great. It is not sufficient to keep the child in bed during the febrile stage alone. Six weeks is the shortest period that any endocardial case can safely be permitted to leave the bed, and it is very rare that it is safe within two months. Crandall would arbitrarily place the time at two months and beyond that be guided by symptoms. Two symptoms are of especial value in deciding this important question of leaving the bed, namely, rapidity and regularity of the heart's action. If it becomes irregular or unduely rapid upon moderate exertion, he insists upon continuing the quiet. The rapidity on exertion, however, must be looked upon with some judgment. A child who has been several weeks in bed, is certain to show rather more rapidity of pulse than one who has been leading an active life. To maintain the restrictive treatment too rigidly and too long after the preliminary stages, is an error. Too much confinement to the house and restriction of muscular action may defeat its own object. We are now at a stage where nutrition must be maintained at its highest possible point; where muscular development should be encouraged, and the child prepared to perform its ordinary duties in life. The management of girls is usually easier in this regard than that of boys.

No general rules can be given. Here, as in the earlier stages, the rate and frequency of the pulse offers the best guide, provided the patient

is in reasonably good physical condition. Action of the heart under exercise is the most reliable guide. If it becomes irregular or unduely rapid, there should be no hesitation in forbidding the more strenuous exercises. After the acute stages of endocarditis are passed, we have to deal with a condition, rather than a disease. In the management of this condition, arbitrary rules may do harm rather than good. In few other conditions is it so essential that we study the case and treat the patient rather than the disease.

*The prevention and treatment of functional heart disease in children*, is the subject of an excellent paper by Nobecourt.<sup>1</sup> He refers to the extremes which may result in impairing the action of the heart. The one is a too sedentary life; the other excessive exercise. Too long confinement in a sitting position increases the work of the heart by reducing the activity of the peripheral circulation. Proper exercise corrects this, but the effects of exercise taken in excess are well known. Nobecourt refers to the fact that the circulation in children readily adapts itself to variations in bodily movements but they do not withstand prolonged exertion. The practical importance of this characteristic, which is recognized by all who are much with children, is very great. Brisk walking is an excellent exercise, but overprolonged or running races may be very injurious. Games and sports are excellent, but the tendency to allow children to engage in competitive games should be discouraged. They are apt to be prolonged and the exertion severe and may result in serious harm.

The recent scientific advances that have been made in the study of etiology of that familiar and related group of diseases—chorea, rheumatism, and endocarditis—point very strongly to a common infective origin. But the question is still unsettled whether the infection is due to a specific microörganism, or whether the infection is due to a particular reaction of the body to a variety of organisms. An exhaustive clinical and bacteriological study of a case of infective endocarditis is reported by Jones and Meine,<sup>2</sup> of the Woman's Hospital of Philadelphia. The case does not clear up any of the mooted points but the blood cultures are somewhat confirmatory of the bacteriological findings of some of the more recently reported cases.

The hospital and out-patient treatment of endocarditis is considered at considerable length by Lucas and Wentworth.<sup>3</sup> An extended study of congenital cardiac disease is reported by Dunn,<sup>4</sup> of Boston. He lays down the following rules for differential diagnosis: (1) A case showing cyanosis with enlargement of the cardiac dullness or palpable thrill, or both, is one of pulmonary stenosis. If the baby dies shortly after

<sup>1</sup> *Annales de Méd. et Chirur. Infant.*, April 15, 1914.

<sup>2</sup> *Archives of Pediatrics*, September, 1914.

<sup>3</sup> *American Journal of Diseases of Children*, January, 1914.

<sup>4</sup> *Ibid.*, September, 1914.

birth, the most probable lesion is pulmonary stenosis alone. If the baby survives early infancy, or lives on into childhood, the pulmonary stenosis is probably associated with some other lesion. If the murmur is notably transmitted into the vessels of the neck, or if a "humming top" murmur is present, the additional lesion is probably open ductus arteriosus. If the murmur has neither of these characteristics, the complicating lesion is probably defective interventricular septum. (2) A case showing a murmur and enlargement, without cyanosis, is probably defective interventricular septum. If the murmur is not transmitted into the vessels of the neck, this lesion exists alone. If the murmur is so transmitted, or if the "humming top" murmur is present, the lesion is probably combined with open ductus arteriosus. (3) A case showing a murmur, without either cyanosis or enlargement, especially if the murmur is markedly transmitted into the vessels of the neck, or if it extends into diastole, is probably one of open ductus arteriosus alone. If the murmur is of the "humming top" variety, extending throughout the cardiac cycle, the diagnosis of this lesion is almost certain.

**Acidosis in Infancy.** An extended article on acidosis in young children is contributed by Marshall,<sup>1</sup> of Ann Arbor. He refers particularly to the type which shows itself in cyclic vomiting. An acute acid intoxication is described by McCleare.<sup>2</sup> It manifests itself as a digestive disorder and must be differentiated from acute digestive disturbance, appendicitis, meningitis, brain or kidney disease, or the acute infections. The etiology is uncertain but it seems probable that there is some potent infection, possibly originating in the tonsils, appendix, or intestines. The toxins apparently act upon the liver and cause disordered fat and proteid metabolism, with the production of toxic bodies which appear in the urine. The attack may develop suddenly or may be preceded by listlessness, anorexia, coated tongue, a pale bluish ring around the mouth and under the eyes, and dusky cheeks. There is usually headache, coryza, injected conjunctivæ, and a variable cough. Apathy, or even coma, is common and is generally preceded by intense nervousness or meningismus. The child looks ill, being pale or even cyanotic, with sunken and dull eyes. The lips are dry and cracked, there are sordes on the teeth, and the tongue is dry and brown with strawberry edges. The skin is dry and harsh, the abdomen is retracted and there are signs of general wasting. On the breath there can be detected the sweetish, fruity odor of acetone. Fever rarely reaches 103° F. The pulse is soft, rapid, and irregular. The bowels are constipated and the urine is scanty and may contain albumin, casts, or blood. Although prostration is marked, death from this condition is rare.

In the treatment, the source of infection should be sought for and

<sup>1</sup> Archives of Pediatrics, February, 1914.

<sup>2</sup> Journal of American Medical Association, November 15, 1913.

removed if possible. Low fat diet with ample amounts of carbohydrates is important to preserve the alkalinity of the tissues. Potassium citrate, given in the form of fruit juices, may be used. Constipation must be watched, a periodic emptying with mild aperients being of use in impending attacks. Sodium bicarbonate is valuable because of its stimulation of the excretion of acid bodies, and because of its protective influence on the body fats. To supply the carbohydrate need, dextrose is used. In cases of extreme drying out of the tissues, a saline infusion may be needed.

The possible sources of acidosis in infancy are considered in an unsigned article in the *Journal of the American Medical Association*, May 30, 1914, based upon studies of Aron and Franz.<sup>1</sup> A condition of acidosis in early infancy is familiar to the modern pediatricist. It may be relative acidosis due to a deficiency in the relative supply of alkali at a period when bases are particularly needed to meet the requirements of a growing organism; or the acidosis may be a positive rather than a relative phenomenon and be attributable to the production of undue amounts of acid products, which for some reason escape further oxidation or destruction in the economy. In the event of the existence of the latter condition, one must call to mind first of all those examples of acid compounds that are known to arise under such circumstances. Most familiar are the lower members of the fatty acid series, such as the volatile formic, acetic, and butyric acids. These are not all uniformly non-metabolizable in the body, for acetic acid and its salts are, as a rule, readily oxidized. Formic acid, once making its appearance, is not so readily destroyed. To account for the possible origin of such compounds would not be difficult, inasmuch as they frequently represent products of the activity of micro-organisms in the gastro-intestinal canal, which is notably liable to excessive bacterial invasion in the disorders of infancy. So far as these substances escape oxidation, they are excreted in the urine. Aron and Franz have examined the urine of various sucklings in the Children's Clinic at the University of Breslau without finding more than the merest traces of volatile fatty acids therein. The quantity was not increased by the enrichment of the diet in fats; and even in acute disturbance of nutrition, in dyspepsia and alimentary intoxications as an accompaniment of which they might have been expected to arise, the results were negative. Another organic acid resistant to destruction by metabolism, is oxalic acid. It has been realized for some time that this arises as a product of fermentative decomposition of carbohydrates; and such a mode of origin has been postulated for those cases in which oxaluria could not be explained as the result of the ingestion of food, as rhubarb, spinach, etc. According to Aron and Franz, the urine of infants brought up on such oxalic-free foods as milk and milk mixtures

<sup>1</sup> Monatsschr. f. Kinderh., 1914, xii, 645.

almost always contains oxalic acid. This is assumed to have either a fermentative origin in the alimentary canal, or an endogenous one in intermediary metabolism. Additions of cane-sugar or other nutrient carbohydrates to the diet seem to augment somewhat the output of oxalic acid. No increase could be associated, however, with acute digestive disturbances. These facts, negative and positive, point to a field of investigation which may yield fruitful suggestion with the respect of etiology of some of the obscure acidoses.

A series of cases of *recurrent vomiting* is reported by Kerley.<sup>1</sup> The following are some of the features presented by them: Rheumatism occurred in one or both parents in forty; sick headache and bilious attacks in forty. The presence of acetone in the urine was noted with very few exceptions, but there were exceptions. A child in an attack may show acetone, and in the next attack the urine may be free. Thirty-seven occurred during the first year; twenty-four during the second year; twenty-one during the third year. The onset in the youngest was at six months. In three the onset was during the eighth year. The severity of the attacks varied widely; in some, the child would vomit but two or three times. These usually represented but two or three cases. In others, the vomiting was protracted and severe. The average was three and one-half days. The longest seizure under observation continued thirteen days. The average interval was eight and three-fourths weeks. The temperature was 102° F. or over in 30; 103° F. or over in 10; 104° F. or over in 6; 105° F. or over in 3. In the remainder there was an elevation of from 100° to 102° F. The average age at outset was two years and eight months.

The management in the main was the same in all. If the case is a pronounced one, the patient is given a diet with few restrictions, except that cow's milk, butter, cream, and sugar are omitted. One egg is allowed, perhaps, every third day. Saccharin is permitted as a sweetening agent in some and very little sugar in any case. Three meals daily are allowed with nothing between meals. Red meat is given scantily three times a week. Poultry and fish are given at other times. In some, skimmed milk is allowed scantily, never more than one pint daily, often less. Kerley thinks that a grave error in our management of many children is the free use of cow's milk, butter, ice cream, and sugar. The further treatment consists in the internal use of salicylate independent, or in combination, as advocated by Ratchford. In a pronounced case 5 grains of sodium salicylate should be given with 10 grains of sodium bicarbonate three times daily at five-day intervals, or 20 to 30 grains of sodium bicarbonate daily for a month or two at first. This drug treatment is carried on with rest periods for months and years, as the case may require. The precipitation of an attack by fatigue and fright

<sup>1</sup> American Journal of Diseases of Children, October, 1914.

is not uncommon. The regulation of life and habits aids materially in the management, but is of little or no use if the carbon content in the food is not reduced to the oxidizing possibilities.

In treating the attacks, in the vast majority of cases, a weak solution of sodium bicarbonate is best retained in the strength of 5 grains to 8 ounces of hot water. This is given freely. As laxatives, the magnesia preparations are best retained and are used when a laxative is required. In considering the *etiology of cyclic vomiting*, Zade<sup>1</sup> asserts his belief that it is due to sudden psychogenic disturbance of carbohydrate metabolism together with irritation of the vomiting centre, wherever that may be located. The chief cause, he believes, is either emotional or mental. The sudden onset and abrupt termination, he holds, sustain this theory, as well as the cerebral character of the vomiting. A case of cyclic vomiting showing markedly one feature not before reported, namely, the presence of lactic acid in the urine is reported by Underhill and Steele,<sup>2</sup> of New Haven.

**Recurrent Sibilant Bronchitis.** As far back as 1879, Ratchford<sup>3</sup> presented a paper under the title of "Lithmic Vomiting" and reported cases which are now known as recurrent or cyclic vomiting and called attention to the fact that such attacks are not infrequently transformed into attacks of true migraine as the child grows older. In that paper he spoke of the toxic dyspnea which may be present in these cases, and described in the same cases acute intestinal attacks associated with diarrhea, which occur without apparent cause with more or less regular intervals, and hazarded the belief that the diarrhea was eliminative and, therefore, a curative symptom. He also expressed the belief that urticaria might be an expression of these same autointoxications. In a recent paper<sup>4</sup> read before the American Pediatric Society, he reaffirms these views and expresses the belief that the symptom-groups commonly described in literature under the titles migraine, recurrent vomiting, recurrent sibilant bronchitis, recurrent coryza, asthma, and urticaria, as they occur in children, are, as a rule, closely allied food intoxications which can be successfully treated by much the same medical and dietetic measures. He calls attention to the clinical fact that recurrent rhinitis and recurrent sibilant bronchitis, which are sometimes associated with severe asthmatic attacks, and almost always with severe paroxysmal cough are very commonly caused by some kind of food intoxication. These recurrent attacks of rhinitis and whistling bronchitis, are one of the most common symptom-groups the physician is called upon to treat, and in most instances may be almost or quite relieved by dietetic treatment.

<sup>1</sup> Arch. für Kinderheilkunde, July 25, 1914.

<sup>2</sup> American Journal of Diseases of Children, August, 1914.

<sup>3</sup> Transactions of American Pediatric Society, 1897.

<sup>4</sup> Archives of Pediatrics, June, 1914.

During the attack, sweets, fats, eggs, and raw fruits are especially avoided. Strawberries, rhubarb, tomatoes, salads, shellfish, tea, coffee, pastry, gravies, cream, cod-liver oil, and alcohol are excluded from the diet. Saccharin may be used instead of sugar and skimmed milk may be allowed. Eggs in every form, even in cooked food are to be eliminated. The following foods may be permitted: Beef, mutton, fowl, fish in moderation, cereals, bread, all vegetables not above proscribed, cooked fruit, skimmed milk, and thick soups. About two months after the patient has recovered from the attack, the above diet may be carefully modified by adding one egg a day; then perhaps, two weeks later milk containing 4 per cent. fat. Some few weeks later small quantities of sugar may be added to the cereals or cooked fruits. After five or six months, the child may return to its regular diet. The patient should have all the out-door air possible and when he recovers from his attack, exercise is desirable. During the attack, constipation should be relieved by magnesium salts. Alkalies in the form of bicarbonate of soda, bicarbonate of potash, or citrate of potash should be given in fair sized doses three times a day. Bicarbonate of soda may be given in 5-grain capsules three or four times a day, or the same sized dose of citrate of potash may be distributed through the food. Tincture of belladonna should be given for a short time in two- or four-minim doses three times a day. In the intervals the belladonna is discontinued, but an alkali of some form should be given for six or eight weeks. In the adult and older children, the following prescription, which Ratchford originated twenty years ago, he still uses: Sodii sulphatis (dry), 30 grains; sodii salicylate (from wintergreen), 10 grains; magnesii sulphatis, 50 grains; lithii benzoatis, 5 grains; tincturæ nucis vomicæ, 3 drops; aquæ distil., to make four ounces. This prescription is put up in siphons and charged with carbonic acid and the patient is directed to take, one-half hour before breakfast, a quantity sufficient to produce at least one bowel movement.

In an article on recurrent bronchitis, Kerley<sup>1</sup> considers that condition in which there are attacks of bronchitis with severe cold, often with bronchial spasm. A small proportion of cases suffer from true asthma. Fever, while sometimes present, is not necessarily a part of the disorder. The child is brought with the story that there are frequent colds, cough, and bronchitis. The bronchitis is usually of an asthmatic type; one attack is barely recovered from before another supervenes. The child is free from trouble during the summer, but with the advent of autumn the so-called colds begin. These cases are to be differentiated from the usual infectious colds, bronchitis, and influenza. These children bear cow's milk fat badly. They also bear sugar badly, attacks being precipitated by free indulgences. The influence of butter, fat, and sugar is shown by the gratifying relief of the patients when these substances

<sup>1</sup> New York State Medical Journal, October, 1914.

are largely removed from the diet. There is faulty oxidation of these high carbon foods. These cases are similar to other periodic illnesses, such as recurrent vomiting, recurrent periodic fever with acetonuria, recurrent eczema, in that the attacks are more apt to occur during the cold months, when the elimination by the skin is less active and when muscular exertion is more in abeyance.

These cases of recurrent cough with bronchitis, usually with spasm, are the result of a systemic intoxication due to the use of certain food substances which the organism is incapable of properly accommodating. As an associated factor, defective skin elimination and absence of adequate muscular exercise are contributory causes. The average child after the sixth year receives two or three times as much energy food as he requires. Milk and sugar are not indispensable for any child after the fifteenth month. The carbohydrates and fats found in vegetables, cereals, breadstuffs, and meats supply all the heat and energy required.

**Influenza in Young Children.** In a paper on this subject, Holt<sup>1</sup> believes that we are now in a position to clear up some of the haze which surrounds this subject. That the term is constantly abused does not prove that there is no such thing as influenza. By influenza is meant an infection or inflammation due to Pfeiffer's bacillus, and only in this sense is the term used in this paper. This organism is one of those associated with inflammations of the respiratory tract and affects chiefly the lower tract, the trachea, bronchi, and lungs, less frequently the upper respiratory tract, the nasopharynx, and ears. The diagnosis is established only by finding the organism in the secretions; usually it must be the bronchial secretions. This renders its discovery difficult in young children for the bronchial secretion is not easy to secure. A diagnosis by the examination of smears is unreliable. Only cultures can be depended on.

The paper is based upon results obtained from 1650 sputum cultures made from 1053 patients at the Babies' Hospital. Several different types were found: (1) Pneumonias with unusual, often extraordinary, fluctuations of temperature, or with persistence of temperature after the physical signs have disappeared. (2) Pneumonias running a protracted course, with slow resolution. Frequently there are recurring attacks. (3) Cases of otitis with mild catarrhal symptoms, often only a moderate cough and a few coarse rales in the chest, but with a temperature quite out of proportion to the general or local symptoms. (4) Cases with very few or no catarrhal symptoms whatever, but with a very unusual temperature curve. (5) Unusual temperature curves accompanying tuberculosis and sometimes other diseases. (6) Cases resembling whooping-cough seen chiefly in older children, seldom in infants.

<sup>1</sup> New York State Journal of Medicine, October, 1914.

**Tongue-chewing in Young Children.** Four cases of this rather unusual condition are reported by Bernard Myers.<sup>1</sup> From his observations and studies of literature he has been led to assert that tongue-chewing is first noted about the second year of life and persists until middle age, or, perhaps, throughout life. It tends to be less noticeable with advancing years. Either sex may suffer from it. It occurs in apparently healthy families in which certain members suffer from habit-spasms. Several members of one family may suffer from it. The habit is inherited as far as one can see, and is not copied. The same side of the tongue is always chewed by the same individual. The mental condition is quite normal, and the general health is not interfered with in any way. Bromides stop the tongue-chewing, but in time, after leaving off the drug, the habit recommences.

**Anorexia Nervosa in Infancy.** Hysterical manifestations in infancy are not very uncommon. One of these manifestations known as anorexia nervosa is discussed by Orchard,<sup>2</sup> of Rochester. All gradations of the condition are to be found, some being simple and others severe and dangerous. This term should be restricted to the more distinctive forms and should not be applied to the more common perversions of appetite or to losses of appetite due to disease.

A negative statement probably best suggests the application of the term anorexia nervosa, that is, if we are able to find any organic lesion causing the condition, we are not dealing with true anorexia nervosa. Forchheimer has expressed it exactly as follows: "There must be absence of organic lesions which would explain the anorexia." The consensus of opinion at present is that it is a neurosis, and while it is extremely interesting to attempt to grasp the underlying psychology, at the same time it must be confessed that there are too many unknown in the equation.

Precocity on the part of the infant, or the presence of a very delicately balanced nervous organism on the part of either parent, must not be disregarded as factors. Forchheimer has reported several cases of anorexia nervosa in children, with a review of literature. His paper includes Friedländer's case, which was considered to be the youngest case in which this condition has been found. Friedländer's patient was one year old. Attempts to wean the child brought about a complete refusal of food. Repeated thorough examinations were absolutely negative. He was removed to a hospital and for four days nothing was taken by mouth despite all skilled effort. Saline solution was given by the rectum. It was not until the end of the second week that the child began to take any food, being sustained meanwhile by gavage.

The case reported by Orchard was that of a healthy infant unincumbered by parental taint, manifesting a determination not to take food.

<sup>1</sup> British Journal of Children's Diseases, March 14, 1914.

<sup>2</sup> New York State Medical Journal, January, 1914.

So far as may be determined, the sole cause was the substitution of a new nipple for an old one. A persistent refusal with the resultant loss of nearly three pounds, to take any food offered in any manner. Added to this was the lack of any organic lesion which could be discovered to explain the disease. Gavage lasted four days, followed by a gradual surrender on the part of the infant.

**Gastric Digestion in Infancy.** After an extended study of gastric digestion, Hahn,<sup>1</sup> of Washington, concludes that the determination of the hydrogen ion concentration is the only rational method of measuring gastric acidity in infants. The important processes in the gastric digestion of infants are the coagulation of milk by rennet and the splitting of fat by gastric lipase; the peptic digestion of casein is unimportant for the infant. In infants from one to four months old fed on one-third cream-milk, the lipase content increases with the age of the infant. In infants from four to twelve months old fed on two-thirds milk, the content of all gastric ferments is greater than in infants from one to four months old on one-third cream-milk. Hess,<sup>2</sup> of New York, reports observations on the physiological anatomy of the infant's stomach noted in using the balloon-duodenal catheter. The article is one of great interest but requires plates to be understood.

**Pyloric Obstruction in Infancy.** This condition continues to be the subject of much observation and study. Last year,<sup>3</sup> I gave extended consideration to the subject. Among several recent papers is that of Downes,<sup>4</sup> of New York, who reports 22 cases from which he draws the following conclusions: Hypertrophic pyloric stenosis is congenital to the extent that there is an increase in the thickness of the circular muscle fibers of the pylorus. The presence of this thickened muscle-fiber reduces the lumen of the pylorus, and, therefore, the stomach in order to empty itself, contracts more forcibly than normal. The abnormal contraction soon causes the mucous membrane to become thickened and edematous, and assume a more or less spiral arrangement as it passes through the more or less thickened pyloric channel. The result is a valvular action which gradually produces complete closure of the pylorus. The question as to whether or not the pylorus will admit a probe or catheter at operation or autopsy is of little consequence when weighed against the clinical evidence of complete obstruction. That there is sufficient time between the outset of symptoms and the appearance of the signs of complete obstruction, for careful observation and the carrying out of any medical measures likely to prove of benefit, there can be no doubt, provided of course, that the early symptoms have been properly interpreted. The fear, however, that the condition

<sup>1</sup> American Journal of Diseases of Children, April, 1914.

<sup>2</sup> Ibid., June, 1914.

<sup>3</sup> PROGRESSIVE MEDICINE, March, 1914, p. 278.

<sup>4</sup> Journal of American Medical Association, June 27, 1914.

may have existed longer than has been suspected, and that the vitality of the baby is not so good as appearances would lead us to believe, makes one feel that operation is indicated in every case of hypertrophic stenosis as soon as the diagnosis is made. Should depression or early evidence of shock be present, immediate operation is demanded. The babies coming to operation in good condition suffer little or no shock; their convalescence is straightforward; and they are at once restored to normal health. The subject is also studied by Hess<sup>1</sup> who has used a special duodenal catheter, both for treatment and diagnosis. By this instrument, the duodenal contents may also be obtained for examination.

**Duodenal Ulcers in Infancy.** Until recently, duodenal ulcers have been considered rare in infancy and childhood. Since 1908, groups of cases have been published by several writers, and the increasing number of reports during the past three years indicates that the condition is not a very uncommon one, and that it has probably been overlooked in the past. Holt<sup>2</sup> presents a study of 95 cases, four being cases of his own, and the remainder being taken from literature. All but 21 of these have been published since 1908. These facts indicate how little this condition was known up to five years ago. In the postmortem records of the Babies' Hospital, embracing 1800 autopsies, fully 90 per cent. of which were of children under one year, duodenal ulcer is recorded but four times, and, curiously, three of these cases were observed within three months, the other case two and a half years before. It is doubtless true that had it always been carefully looked for other cases might have been discovered.

Holt concludes that in the etiology, atrophy is the most important predisposing cause. Seventy per cent. of the cases occurred between six weeks and five months. The ulcers were nearly all situated above the papilla, and showed, macroscopically, a punched-out appearance; microscopically, an absence of round-cell infiltration. As to the symptoms, in one-third of the cases there was none attributable to the ulcer. Hemorrhage was the only definite symptom; blood in the stools of an atrophic child in the absence of a diarrhea should suggest an ulcer. Collapse, with a concealed hemorrhage, occurred in a certain number of cases. As to diagnosis, he commends the passage of a duodenal catheter. In one case of his own the presence of blood in the eye of the tube established the diagnosis. He believes that the danger from this procedure is slight. The gastro-intestinal symptoms preceding duodenal hemorrhage are usually of a mild type and subacute, so that enterocolitis with its frequent bloody and mucous stools is not likely to be confounded with ulcer. There is lacking also the persistent vomiting (not bloody), the paroxysmal pain, the tenesmus, with the passage of blood and mucus from the bowels, but no fecal matter, all of which are characteristic of intus-

<sup>1</sup> American Journal of Diseases of Children, March, 1914.

<sup>2</sup> Ibid., December, 1913.

susception; although the age of the patients, the suddenness of the invasion and the acute prostration sometimes suggest it. With blood appearing both in the vomitus and in the stool, one might be in doubt as to whether the lesion were gastric or duodenal. The far greater frequency of duodenal ulcers of course makes this lesion much the more probable one. Of 65 cases in which the age of the infants with duodenal ulcers is given, 70 per cent. of the patients were between six weeks and five months old, the greatest frequency being between the sixth and tenth week.

**Infant Feeding.** The subject of infant feeding is still in a confused and uncertain state. In some regards it is more confused than it was years ago. But this does not necessarily mean that no progress has been made. Added knowledge frequently upsets previous teachings and for a time may cause confusion rather than unanimity of opinion. When knowledge in so complex a subject as infant feeding, continues to be added from year to year, a period may come when that subject may be greatly confused. In a very judicious recent article, Pisek<sup>1</sup> refers to the fact that during the past fifteen to twenty years there has been accumulating a mass of knowledge concerning infant feeding which has not been digested nor assimilated by the medical profession as a whole. Too often a new contribution to this subject has been hastily seized upon and made the basis of a so-called system of infant feeding instead of being assigned its relative position in the general scheme of infant feeding.

Babies have survived all these fashions, and in spite of them the death rate has declined. From the standpoint of the practicing physician there was no cause for complaint when there was but one fashion displayed at a time; but now, when all fashions are in style at the same time, the situation has become complicated. Every physician who practices among infants, has had mothers or nurses watch him critically to see if his feeding agrees with that recommended in some Book for Mothers written by more or less well known pediatricians. If he departs from the plausible rules positively laid down he is suspected of being unskilled. If he explains that the author of the book advises a method not applicable, or that he is actually wrong in his statements, or that the rules were intended for different conditions he at once creates doubt as to whether physicians really know much about infant feeding after all. A house divided against itself must fall and scientific infant feeding will fall into disrepute unless this division of medical opinion ceases to exist and teachers become more consistent in their statements.

Pisek asserts that we must approach infant feeding from a new standpoint, and we will approach it from a new standpoint when we concen-

<sup>1</sup> New York State Medical Journal, January, 1914.

trate our teaching on broad general principles of scientific nutrition, of which infant feeding is only a branch. Complaint is made by teachers in a well known school of domestic science training in dietetics, that their graduates find themselves not understood by the physicians whom they are expected to assist. The training of the laity in the science of nutrition is going on rapidly and unless the medical profession appreciates this and stops following fads and fancies, instead of mastering the rudiments of the general science of nutrition, particularly as they apply to infants, the profession must not be surprised to see manufacturers swamping the field with their alluring literature. The fundamentals of chemistry, physics, bacteriology, and surgery are uniformly taught, and the graduate of one school does not find his training different from that of another school. In infant feeding, it is different. By diverse opinions expressed to patients regarding the former feeding of their baby, and the willingness of the untrained doctor to experiment with food after food, or preparation after preparation in the hope of finding one that will fit, a fertile field is prepared for proprietary food manufacturers who can and will occupy it with their products unless the physician will make the effort to fit himself for the care of this class of patients. There is no such thing as new principles of infant feeding. There is, however, a periodic appearance of new methods of infant feeding which are temporarily in vogue until the stern logic of practice proves them to be founded upon misconceptions of the elemental principles of nutrition.

In considering the *caloric value of diet*, Gittings<sup>1</sup> asserts that the estimation of caloric value of diets must not be considered as a compulsory dietetic indication and due regard must be had to the effect of diet on digestion. On the other hand, it is undoubtedly true that caloric insufficiency, or excess, if persisted in, is reasonably sure to be followed by digestive disturbances. In discussing this paper, Dunn<sup>2</sup> said that he had always felt, from his clinical observations, the fallacy of the minimum caloric requirement. He had been tabulating the caloric value of the diet taken by about all the infants in his wards and found that the extremes were so great that no conclusions could be drawn or any system of averages that could be of value. The method of taking normal babies and average results was apt to be misleading and where there were wide extremes, the average might be absolutely false for every individual baby. Some made no gain on the lower caloric values and gained when the calories were increased, and in some the minimum number of calories had to be doubled before the infant began to show a gain. The problem was complicated by individual differences in nutrition and digestive powers so that the conclusions were of no value even as a guide in the average case. Chapin<sup>3</sup> said that he believed that the

<sup>1</sup> Archives of Pediatrics, September, 1914.

<sup>2</sup> Ibid., June, 1914.

<sup>3</sup> Ibid.

value of the caloric method of feeding had been overestimated. It was the assimilation of nutrition and not the heat produced that was of value. It should be remembered that the food elements must be in the proper proportion and that they are not interchangeable. In the feeding of infants, one must provide for growth, and it is not so much a problem of heat production as of whether the food was capable of causing growth.

In an extended study to determine *why sodium citrate prevents curdling of milk by rennin*, Bosworth and Van Slyke<sup>1</sup> asserts that the result of such use has never been explained on the basis of actual investigation. Work previously done by the authors suggested a chemical explanation of the observed facts and led them to test the matter by an experimental study of the action of sodium citrate on milk. The addition of sodium citrate to normal milk increases the amount of soluble calcium in the milk, this increase resulting from the action between the calcium caseinate of the milk and the sodium citrate by which is formed sodium caseinate (or calcium sodium caseinate) and calcium citrate. The reaction is reversible. The curdling of milk by rennin is delayed by the presence of the sodium citrate; when there is added 0.4 gm. of sodium citrate per 100 c.c. of milk (equal to 1.7 grains per ounce) no curdling takes place. The curd produced by rennin in small amounts of sodium citrate 0.05 to 0.35 gm. per 100 c.c. (0.2 to 1.5 grains per ounce), increases in softness of consistency as the amount of sodium citrate in the milk increases. The results of their work indicate that at the point at which rennin fails to curdle milk, we have in place of the calcium caseinate of normal milk a double salt of calcium-sodium caseinate; this double salt when rennin is added, is changed to a calcium-sodium paracaseinate which, owing to the presence of the sodium, is not curdled. The practice of adding sodium citrate to milk at the rate of 1 to 2 grains per ounce of milk appears to have a satisfactory chemical basis in the reaction between the sodium citrate and the calcium caseinate of the milk. The amount added is governed by the object in view, viz., whether it is desired to prevent curdling or only to modify the character of the curd in respect to softness.

<sup>1</sup> American Journal of Diseases of Children, April, 1914.

# RHINOLOGY AND LARYNGOLOGY.

BY GEORGE B. WOOD, M.D.

**Diphtheria.** There has been for some time a constant effort to find a satisfactory method of destroying the diphtheria organism in the upper air passages of carriers, and of interest in this line is the article by Ten Broeck.<sup>1</sup> He has experimented by inoculating patients suffering from diphtheria with the *achlya muscaris* and thallophytic fungus. These genres are for the most part saprophytic and more often parasitic in animals (salmon, insects) than in man, the infections in man being self-limited and amenable to treatment. The results of his experiments were so favorable that he went so far as to inoculate his own throat with a diphtheritic membrane taken from one of his patients which had been treated by the fungus eighteen or twenty hours previously. No diphtheria bacilli could be found in his throat, and a temporary congestion rapidly disappeared. He repeated this experiment in one or two other instances. He has used the fungus in sixty-five cases without any complications. His original method of preparation was to grow the fungus on defibrinated blood, to wait ten days for spore formation and then filter. Spores and filtrate were mixed with ten times their weight of lactose as a diluent, and 5 to 7 grains deposited on the tongue. The second inoculation was generally repeated in three hours. In six hours the signs of growth were generally noticeable. After twenty-four hours it was advisable to use a mild antiseptic gargle to clear out the throat.

His conclusions are:—"First, the *achlya muscaris* possesses the power to destroy the diphtheria bacillus in culture and in the throat. Second, throat inoculations of this fungus are usually self-limited and easily controlled. It may require some adjusting in the way of repeated inoculations or inoculations in special areas or under special conditions to embrace all complications in the nose or other recesses. Third, it has the power of inhibiting the growth of a number of throat pathogens and seems to influence favorably membranous anginas of various origins. Fourth, its clinical use seems to be attended with no danger, but after-treatment with mild antiseptic is recommended to remove the fungus. Fifth, it is applicable in all stages of the disease and seems to give speediest results in the early cases. Sixth, there are grounds for believing that a throat in which this fungus is growing is soon shorn

<sup>1</sup> Medical Record, January 10, 1914, vol. lxxxv, No. 2, p. 49.

of its danger of contagion, even if the diphtheria bacilli are still harbored. Seventh, it is admirably adopted to clinical requirements for reliable and ready use.

"These conclusions are offered not as definitely established but as established in so far as the limited observations here recorded can establish any conclusions."

The rather insufficient amount of data prevents an unconditional acceptance of these results, especially so when we remember the similar promises which accompanied the original articles on the value of the staphylococcus spray. Also the lactic acid bacilli which last year promised useful service in this line has been shown to be useless by Goltz and Brodie.<sup>1</sup> In their investigations the average quarantine period is not reduced in the slightest by the use of living lactic acid organisms though there does seem to be an earlier disappearance of the membrane when they are used.

Perhaps more hope for the development of a method of destroying the bacillus is to be found in the various attempts at *active immunization*. Weil<sup>2</sup> reports his results following vaccination with the killed Klebs-Loeffler bacillus. At first he uses the stock vaccine, beginning with 20,000,000, increasing the dosage every three or four days until a maximum dose of 400,000,000 has been reached. Six injections are all that was used in each patient. If, after an interval of twenty days, the case is still found to be a carrier, an autogenous vaccine is made and employed. The local reaction, though sometimes fairly severe, is never sufficient to cause inconvenience to the patient. There is seldom any rise in the temperature, and there is no relation between the amount of reaction and the efficacy of the treatment. He concludes that the use of vaccine does have an influence in destroying bacilli of chronic carriers and that the number of bacilli is markedly diminished by the use of the vaccine even where they do not entirely disappear. The diphtheritic vaccine can be used in comparatively large doses, and large doses are more efficacious than small ones.

As far as *chemical sterilization of the throat* is concerned, the use of iodine fumes, as suggested by Abel,<sup>3</sup> presents a somewhat new idea. Abel says that the only way to thoroughly sterilize the throat is by the use of vapor, as nothing else so infallibly enters into all the crevices, and he advises iodine for this purpose. He generates the nascent iodine by heating iodoform in a flask, through the stopper of which enter two tubes. When the iodine fumes have filled the flask, he blows the fumes, by means of a rubber bulb, through the nostrils into the pharynx. He repeats this treatment twice a day for three days. In 89 cases thus treated, the bacilli disappeared in 47 per cent. after three days of treat-

<sup>1</sup> Journal of American Medical Association, June 6, 1914, p. 1779.

<sup>2</sup> Laryngoscope, September, 1914, vol. xxiv, p. 804.

<sup>3</sup> Therapie der Gegenwart, December, 1913, vol. liv.

ment. Thirty-one and one-half per cent. required two courses of treatments, and 20 per cent. required three courses of treatment; while two patients proved absolutely refractory. If heroic measures are essential for the eradication of diphtheria bacilli from carriers, it would seem the above method of treatment fills the bill as far as heroism is concerned, and when the iodine fumes are sufficiently diluted to be borne by the patient, I would doubt its efficacy as a germicide.

Park and Zingher<sup>1</sup> have been attempting *active immunization in diphtheria* patients by the use of toxin-anti-toxin mixtures. They found that this method of active immunization produced a great amount of anti-toxin in a relatively short time in all persons who had natural anti-toxin. They used the Shick reaction test for the determination of the natural immunity. This reaction depends upon the local irritant action of toxin in the absence of anti-toxin. A dilution of the toxin is made of such strength that 0.1 c.c. contains about  $\frac{1}{50}$  minimum lethal dose for the guinea-pig. When injected intracutaneously, a positive reaction is characterized by redness and infiltration which remains from seven to ten days. The majority of people show no reaction and such he considers are susceptible to diphtheria.

In seven hundred scarlet fever patients, four hundred gave negative reaction. They conclude that active immunization is indicated where there is no immediate danger of infection and when it is desirable to lessen the number of susceptible persons. They are, however, not especially enthusiastic over this method of producing immunity, as the immunity only lasts for one or two years.

## NOSE.

**Nasal Obstruction.** For some time it has been shown that nasal obstruction, outside of any local discomfort which it may cause, is very apt to be followed by lessened physical resistance. Wotzilka<sup>2</sup> has made a series of observations to determine, if possible, whether nasal obstruction predisposed to tuberculosis. In the examination of sixty-seven tuberculous men and thirty-three tuberculous women, he found that forty-five were unable to breathe normally through the nose. As a control he found that out of one hundred non-tuberculous persons only thirteen had difficult nasal breathing. This data is not sufficiently great to make any conclusions but the evidence advanced is confirmative of our belief in the importance of nasal breathing to the health of the individual.

**Hay-fever.** The various vasomotor conditions of the nose, in their clinical aspects are closely allied, but in their etiology differ exceedingly. An ordinary neurotic vasomotor rhinitis is very similar to an

<sup>1</sup> American Medical Association, September 5, 1914, vol. lxiii, p. 859.

<sup>2</sup> Medizinische Klinik, Berlin, May 31, 1914, vol. x.

attack of hay-fever, but in their etiology they have nothing in common. A patient suffering from one variety of the hay-fever group may fail to give any reaction to irritants which causes a congested mucosa in another patient; and it is difficult to understand why one person will be immunized to the rag-weed pollen and show intensive reaction to the pollen of grasses or to the emanations of various animals, but such is the case. It is probable that all of these specific vasomotor rhinitis cases are anaphylactic reactions, one person being sensitized toward one toxin and another against another.

That there is an exact specific reaction to these various toxins is shown by Goodale<sup>1</sup> who has carried out a series of experiments concerning the anaphylactic reaction occasioned in cases of horse asthma. His idea was to determine whether individuals who are suffering from vasomotor symptoms when in the neighborhood of horses would give anaphylactic reaction to injections of horse-serum. Tests were made, first, by placing a drop of diphtheria anti-toxin on the lobe of the ear and then making through it a small superficial cut with a paracentesis needle, and, second, by placing a drop of the same antitoxin in one nostril upon the anterior end of the lower turbinate. Eleven cases were treated in this manner, all of whom had a history of sensitiveness to horses. In five of the patients the application of horse-serum to the skin-abrasion produced, within a few minutes, sharply localized edema and reddening. In three of these cases the introduction of horse-serum into the nose caused edema of the nasal mucous membrane, together with a profuse watery discharge and sneezing. One case of horse vasomotor rhinitis without asthma gave a delayed reaction to the nasal test but was negative for the skin test. A similar case gave a delayed but definite reaction to the skin test but showed no nasal symptoms. Four of the horse-fever cases without asthma were negative for both tests. As a control test, he found that six cases of bronchial asthma and five cases of hay-fever were negative for both tests. The severity of vasomotor symptoms of the patient examined appears to be a determining factor in the production of the reaction, as, for instance, patients with nasal symptoms alone do not appear to be sufficiently sensitized to horses to give an immediate positive skin test. The practical result of this work lies in the fact that the patients suffering from horse-asthma may be given a dangerous anaphylactic shock by the hypodermic administration of horse-serum.

In the TREATMENT OF HAY-FEVER there has been an attempt during the past year to actively immunize patients *by the injection of pollen toxin*. Ulrich<sup>2</sup> prepared an extract from the pollen of rag-weed by following the plan of Dunbar, which consists of making a 5 per cent. suspension of pollen in normal salt solution and alternately freezing

<sup>1</sup> Annals of Otology, Rhinology, and Laryngology, June, 1914, vol. xxiii, p. 273.

<sup>2</sup> Journal of American Medical Association, April 18, 1914, p. 1220.

and thawing the mixture. With this extract he has treated twelve cases of hay-fever during the past season. He injected about 0.5 c.c. of a dilution never greater than 1:500,000 nor less than 1:1,000,000, of this extract at intervals of one, two, and three days. He found that the patient, in the majority of instances, was relieved partially or wholly from symptoms in from fifteen minutes to two hours. This relief lasted from a few hours up to several days, one week being the longest; and there was a gradual, lasting improvement of symptoms in the majority of cases that could not fully be explained by a possible diminution of pollen in the air.

Lowdermilk<sup>1</sup> prepares his toxin from varieties of the Ambrosia and the different varieties of the Solidago. The pollen of these plants was ground with sand and afterward allowed to stand at room temperature for twenty-four hours with frequent shaking, was pipetted off, centrifuged and sealed in glass ampoules containing 1 c.c. For convenience, the unit system was used. The unit represented the quantity of toxin extracted from 1 microgram (0.000,001) of pollen. The dosage in each case was regulated by the nature and extent of the reaction produced. Efforts to determine the proper dosage in advance, by means of the ophthalmic and cutaneous reactions, were found to be unreliable. At first, the interval between doses was from five to eight days, but this was reduced, after a little experience, to one or two days depending on the time required for the reaction from the previous dose to subside. In three cases treated, the dosage varied from 25 to 1000 units to each injection, and in each of these cases complete immunity resulted. In these cases the treatment had been begun about a month before the annual onset. Of 16 patients treated after the onset, 13 were cured, and, in the 3 not benefited, the treatments had been delayed until a month after the onset of symptoms.

Koessler,<sup>2</sup> in the last four years, has treated 41 cases of hay-fever by active immunization with pollen extracts. The large majority of these patients were markedly improved, and 4 were entirely cured for at least one year. Those suffering from asthma were altogether relieved as far as the asthma symptoms were concerned.

John Freeman,<sup>3</sup> in his experience with active immunization against hay-fever, says that with patients who had marked constitutional disturbances, such as asthma, he had better results than with patients with slight local symptoms; and those with inherited tendencies than with those in which such tendencies did not exist. He states in his conclusions that the hay-fever treatment by active immunization was successful, and the immunity thus acquired seems to last at least one year after treatments had been discontinued.

<sup>1</sup> Journal of American Medical Association, July 11, 1914, p. 141.

<sup>2</sup> Illinois Medical Journal, August, 1914, vol. xxvi, No. 2.

<sup>3</sup> Lancet, April 25, 1914, p. 1178.

Although there is some promise in the possibility of active immunizations against hay-fever, this prophylactic treatment is too much in its infancy to be recommended to general practitioners, and remembering the great eclat with which Dunbar's antitoxin was introduced and the popularity which it had for two or three years after its introduction, we hesitate somewhat in being too enthusiastic about the results that are to be obtained by this method of active immunization.

In a somewhat similar manner we hesitate to accept with any great enthusiasm the results which Farrington<sup>1</sup> claims for the treatment of hay-fever by use of the ordinary *autogenous vaccines*. The vaccine is prepared by passing a platinum loop well up along the middle turbinate and transferring a film of secretion to sterile agar tubes. The patients are instructed not to use medicine of any kind twenty-four hours before the cultures are made. Two tubes are used in each case, and the combined growth washed off with a sterile normal saline solution. The bacteria are then killed by heat, standardized, and placed in two ounce bottles with inverted rubber nipples for stoppers. The author believes that this autogenous vaccine offers much more hope of success in the treatment of hay-fever than all the other known methods combined.

It might be well at this place to say a word concerning all autogenous vaccines made from the nasal cavities. It is exceedingly likely that most of the cultures made from the nasal fossæ are chiefly contaminations from the nasal vestibules. Unless great care and some especial form of technique is used it is impossible to pass a swab or oese into the nose without touching the vestibular hairs. Painting the inside of the speculum and neighboring portion of the nasal mucosa with tincture of iodine immediately before introducing a sterile platinum loop is probably the simplest way of overcoming this difficulty.

Loew<sup>2</sup> revives the use of *calcium chloride in the treatment of hay-fever*. He says that this drug should be given three times daily for three months before hay-fever time and it is even better to give it throughout the year. He believes that while not every case of hay-fever will show a similar response to this drug, the large majority, if the treatment is carried out faithfully, can be called cured. The theory of the action of calcium chloride is that, in these cases which are generally of the gouty diathesis, there is a disturbed metabolism of the calcium salts and hence an excess of calcium salts is needed by the body tissues.

**Nasal Deformity.** Lothrop<sup>3</sup> proposes the following procedure for the correction of AQUILINE NASAL DEFORMITY. Under general anesthesia a limited area of the extreme anterior portion of the nasal septum is denuded of its mucoperichondrium and the anterior edge of the quad-

<sup>1</sup> Laryngoscope, December, 1913, vol. xxiii, p. 1133.

<sup>2</sup> Münchener medizinische Wochenschrift, December 2, 1913, vol. lx, No. 48, p. 2676.

<sup>3</sup> Boston Medical Journal, May 28, 1914, vol. clxx, p. 835.

rilateral cartilage is shaved off down to the line desired in the reconstruction of the bridge. A piece of the perpendicular plate of the ethmoid close under the nasal bones is also removed. Two incisions, one in each nasal fossa, are now made through the mucous membrane on the lateral walls of the nose so as to permit elevation of the periosteum covering the external surface of the nasal bone and ascending processes of the superior maxilla. With a specially made bone-punch, a V-shaped piece is removed subperiosteally from each nasal bone with the apex upward. After the removal of this V-shaped section, the nasal bones can be easily fractured and depressed to their new position.

Lothrop<sup>1</sup> also suggests that when a piece of bone has to be utilized for the formation of a new bridge for the nose, a portion of the edge of the scapula can be used to considerable advantage. A strip of bone two inches long and about one-quarter of an inch wide is removed with bone forceps from the posterior border of the scapula, great care being taken not to denude the removed bone of its periosteal covering. An incision of about a quarter of an inch is made in the under-surface of the tip of the nose and then a sub-dermal passageway created up to and over the bridge of the nose. Through this incision, the periosteum is elevated from the external surface of the nasal bone up to the frontal bone. After shaping the strip of bone taken from the scapula, it is introduced under the periosteum, and in about four weeks it will be found to have united to the nasal bone.

Apparently, THE SUBMUCOUS RESECTION OF THE NASAL SEPTUM has reached a certain amount of perfection, because, during the past year, there has been little in the description of the operative technique that is new or that presents any improvement over the operations that are already in vogue. Leonhard<sup>2</sup> believes that in certain deflections of the nasal septum where there is a low ridge-like deflection close to the floor, a better approach for the removal of the cartilage and the bone can be accomplished by making an incision on each side of the septum. This operation evidently aims at making the elevation of the mucoperichondrium and periosteum over the more difficult area an easier procedure by the two incisions enabling the operator to directly attack each side. The two incisions are placed so that they do not correspond in their position, and therefore the occurrence of a perforation is not likely.

I can see no marked advantage in this bilateral incision, as the mucous membrane on the one side can be as easily elevated through the incision on the other side, once the cartilage has been penetrated.

The submucous resection of the nasal septum has become very popular and is evidently being done by all manner of specialists, whether capable or not, so that we are beginning to see the results of imperfectly

<sup>1</sup> Boston Medical and Surgical Journal, August 20, 1914, No. 8, p. 303.

<sup>2</sup> Journal of Laryngology, Rhinology, and Otology, August, 1914, vol. xxix, p. 419.

done operations. Lovinstein<sup>1</sup> calls attention to a deformity which he calls the "duck bill nose" that follows the submucous resection of the septum when the whole of the quadrilateral cartilage has been removed. This deformity, which is due to the taking away of the support of the anterior edge of the septal cartilage, is characterized by shortening and broadening of the tip, some sinking in of the bridge of the nose just below the nasal bones and the formation of a furrow down the front of the lower part of the nose between the lateral cartilages.

It will also be remembered that somewhat similar deformities sometimes follow when a large portion of the cartilage is removed in children, the facial structures of whom have not reached their full development. Just as it behooves the operator when dealing with anterior deformities not to remove the entire support of the front part of the nose when he excises the deformed quadrilateral cartilage, so it is important that the surgeon should hesitate before doing a submucous resection on growing children.

The most frequent deformity following the submucous operation is a permanent perforation of the septum. When this occurs anteriorly, it is much more serious than when in the posterior part of the septum. Probably because in the latter case the opening is sufficiently far back not to be easily reached with a finger and also is kept continually moist by nasal secretions. The patient is generally unaware of the existence of a posterior perforation if it is sufficiently large not to give rise to a whistling sound during breathing. The most common point of perforation, however, is anteriorly, where the cartilage has been first incised. Dutrow<sup>2</sup> says that these anterior perforations would be scarcely possible if the incision through the cartilage is made in an oblique manner. The advantages of this oblique incision through the cartilage are that it permits an elevation with the point of a dull elevator in the apex of an acute angle, which materially arrests the liability of the point of the elevator passing through the delicate mucoperichondrium, and, further, should perchance the elevator perforate at this position the holes on the two sides will not be opposite to each other. When, during a submucous operation, the flaps have been accidentally cut in such a manner as to make it probable that a permanent perforation is going to take place, Simpson<sup>3</sup> proposes what is apparently a very good scheme. He places between the two mucoperichondrial flaps a portion of the cartilage of the nasal septum in such a position so that it will cover the openings. This cartilage gives the support and a place for attachment for the flap of the mucous membrane and

<sup>1</sup> *Zeitschrift f. Laryngologie, Rhinologie und ihre Grenzgebiete*, 1914, Band vii, p. 8.

<sup>2</sup> *Lancet-Clinic*, January, 1914, vol. cxi, No. 3, p. 60.

<sup>3</sup> *Journal of American Medical Association*, July 4, 1914, p. 30.

this does away with the retraction which is so liable to occur without proper support. A similar procedure is also useful in an attempt in closing already existing perforations.

### OZENA.

Perez and Hofer<sup>1</sup> reiterate their belief in the specificity of ozena, declaring that this disease can no more be looked upon as a disease of unknown or uncertain origin, but that it is a specific disease, infectious, contagious, and caused by a coccus-bacillus discovered by Perez in 1899. This organism is gram-negative, stains with anilin colors, is immovable, aërobic and facultative aërobic. It develops easily at body temperature, or the ordinary temperature of the incubation oven, on almost all culture media. In large doses it kills animals in twenty-four hours, occasionally later. Previous to death, the animal shows an increased nasal secretion, which is suppurative and sometimes hemorrhagic. Pathologically, there is a high degree of inflammation of the mucous membrane of the nasal cavities, chiefly in the anterior turbinates. Pure culture of the coccus bacillus can be obtained from the nasal secretions.

Believing in the specific nature of ozena, Hofer,<sup>2</sup> associated with Kofler, has been experimenting and developing a *vaccine therapy* for the cure of this very obstinate disease. The vaccine is prepared by taking a number of strains of the ozena bacillus of Perez and suspending them in a normal salt solution. The bacilli are killed with heat and then a 5 per cent. carbolic acid solution is added to the vaccine. After standardizing, it is ready for use. The reactions following the injection of the vaccine may be divided into three groups, first, the local reaction consisting of redness and swelling around the seat of the injection; second, the systemic reaction, manifested by fever, debility, etc., and third, the focal reaction at the seat of the disease and resembling an ordinary coryza. There is free discharge from the nose, blockage and more or less throbbing pain over the forehead.

The vaccine is used in doses beginning at ten million and running up to five hundred million. The injections are made about a week apart and should be continued for a greater length of time than is ordinarily thought necessary in vaccine therapy. If there is no reaction, either local or general, the dose should be increased in strength, as it is the severity of this reaction that acts as a guide for the size of the dose. They detail the histories of fifteen patients treated by this method. Of these fifteen, three cases were refractory and showed little improvement, but all of the other cases showed very marked benefit. Two patients returned, soon after stopping treatment, with a recurrence of

<sup>1</sup> Berliner klinische Wochenschrift, December 29, 1913, vol. 1, p. 2411.

<sup>2</sup> Archiv f. Laryngologie und Rhinologie, 1914, vol. xxix, Heft 1, p. 1.

the catarrhal condition, but this recurrence easily yielded to a few injections. Hofer and Kofler believe that this method of active immunization furnishes a treatment for genuine ozena which has had, and will have, very good results.

Among the various *drugs* which have been at our disposal for the treatment of atrophic rhinitis, Weelock<sup>1</sup> has selected a salve of *scarlet red ointment*. He is very enthusiastic over its use even in the more hopeless or obstinate cases. After the crusts have been removed by lavage and forceps, it should be well rubbed into the whole of the nasal membrane as well as that of the pharynx. W. C. Wood also believes in the efficacy of scarlet red and uses a 5 per cent. ointment.

**The operation on the nasal lacrymal duct** has recently been taken up by the nasal surgeon with considerable enthusiasm. Ever since Toti's operation was introduced, various techniques have been tried and proposed for intranasal operations in disease of the lacrymal canal. A rather simple method has been developed by Choronshtsky<sup>2</sup> which, because of its simplicity, possesses an advantage over some of the other procedures. The technique is as follows: A very narrow, fine, but strongly made, sound with a sharp point is introduced into the inferior puncta, which has not been previously slit. The instrument should have a strong handle. The point of it is pushed into the lacrymal sac and forced through the lacrymal bone into the nasal fossa. Care must be taken that the point does not encroach on the nasal process of the frontal bone but against the lacrymal bone, and to avoid this the point of the instrument should be directed downward and inward at an angle of about 30° to 40° with the horizontal plane. If the point is directed too far backward the needle goes through the anterior end of the middle turbinate. The penetration is usually easy, but sometimes, where the canal shows thickening, considerable force is required. When the lacrymal bone has been penetrated, the point of the needle appears in the nose just in front of the anterior end of the middle turbinal. The cutting edge of a slightly curved gauge is placed 5 or 6 millimeters in front of the needle point and a small portion of the bony wall of the duct removed. After the removal of a sufficient amount of bone, a blunt-pointed probe is placed in the lacrymal sac so that the sac can be pushed into the nasal cavity, where it may be opened or dissected out as desired. The advantages of penetrating the nasal wall of the lacrymal sac are, that it gives the exact location for the attack through the nose, and avoids unnecessary removal of bony structures. When a permanent fistula is desired, a thread should be introduced through the inner canthus of the eye into the nose through the opening already made and drawn out of the nostril and tied to the other end over the cheek.

<sup>1</sup> Laryngoscope, October, 1913, vol. xxiii, p. 986.

<sup>2</sup> Archive f. Laryngologie und Rhinologie, 1914, Heft 3, p. 363.

## ACCESSORY SINUSES OF THE NOSE.

A rather important contribution to the **pathology of accessory sinus disease** is that by Beck.<sup>1</sup> Especially interesting is his finding in cases of asthma, where he believes that he has found pathologic conditions of the bone in the middle turbinals and the ethmoid cells. The condition is somewhat similar to osteomalacia occurring in other bones. Further, he believes that this finding is suggestive of a common etiologic factor which is based upon some disturbance in the polyglandular system and the glands of internal secretion. In non-suppurative sinusitis there is a conspicuous absence of round-cell infiltration and also an absence of any excessive inflammatory edema or myxomatous degeneration. In chronic suppurative sinusitis, the early stages show marked round-cell infiltration, chiefly in the sub-epithelial structures. The glands are partially destroyed and the epithelium is infiltrated with the leukocytes, while the bone in the early stage shows very little, if any, change. Later, fibrosis of the mucous membrane becomes prominent, and then the bone is generally infiltrated with round cells. He found that, in cases of long standing disease, curettement of the ethmoids showed areas of necrotic bone. In the larger sinuses there may be some myxomatous degeneration with absence of the normal structures, marked round-cell infiltration and only a thin layer of flattened epithelium. The epithelium, however, is not always thinned out, but at times it is apparently hypertrophied. Beck goes on to say that the presence of the epithelium will prevent a spontaneous obliteration of the cavities, hence, in operation, its complete eradication is necessary in order to obtain complete occlusion. In the early stages of atrophic rhinitis he found a rarefying osteitis very similar to that found in the non-suppurative sinusitis, and he is inclined to believe that there may be a common etiologic factor, namely, a disturbance of the glands of internal secretion.

In this article Beck jumps at his conclusion rather too quickly. His pathologic evidence is not always convincing as to the truth of certain dogmatic statements. For instance, he does not show any positive evidence that the presence of the epithelium in the sinus cavities prevents spontaneous obliteration of the cavities. Theoretically, it would be reasonable to suppose that a sinus cannot be obliterated without the loss of the epithelium, but it is also true that sometimes sinuses that have never been operated close almost entirely, spontaneously. His finding of a rarefying osteitis of the ethmoid bone in asthma is certainly interesting, but I would like to see more evidences advanced before accepting his suggestion, that this rarefaction is due to a disturbance in the glands of internal secretion.

In the **X-ray diagnosis of sinus disease**, the most difficult sinus to obtain satisfactory pictures of is the sphenoidal sinus. Macfarlan<sup>2</sup>

<sup>1</sup> Annals of Otolaryngology, Rhinology, and Laryngology, December, 1913, vol. xxii, p. 913.

<sup>2</sup> Laryngoscope, May, 1914, vol. xxiv, No. 5, p. 485.

calls attention to the advantages of the extended chin position for the diagnosis of diseased sphenoids. Care must be taken to get the full extension of the chin, otherwise the sphenoids are thrown into the heavy shadow of the jaw. He says, further, that in making a diagnosis of an accessory sinus disease from *x-ray* plates, it is very essential that numerous pictures should be made. As to the other cavities, he says the frontals show up best in an extreme brow position, the ethmoids best from plates taken laterally, and the antra show best on plates taken in the ordinary chin position.

Freystadt<sup>1</sup> proposes a rather unique scheme for getting a shadow of the sphenoidal sinus from the *x-ray*. She uses a small film on a specially constructed holder which is carried through the mouth and placed in the vault of the pharynx. The *x-ray* tube is placed over the head so that the rays pass from the vault of the skull just in front of the vortex directly downward. When properly taken, there appears on the film the edge of the choanæ, a part of the nasal septum, and the septum of the sphenoidal sinuses and a portion of the right and left sinuses. However, the reproduction of the plates shown in this article are not very satisfactory, and also it would seem that this method is only applicable in those where there is very little pharyngeal reflex.

There has been a tendency during the past year, as far as **operations on the frontal sinuses** are concerned, to avoid, if possible, radical procedures, such as the Killian or other mutilating operations. There is evidently a feeling that the large number of frontal sinus cases can be cured without obliteration of the cavities and that, in the majority of cases, it is preferable not to remove the lining mucosa.

H. A. Lothrop<sup>2</sup> gives a very careful anatomical review of the frontal bone, its attachment to the surrounding bones and the relation of the frontal sinus and ethmoidal cells. The technique of the operation which he has developed from this study of the anatomy is worth considering in detail. This operation, although carried out through an external wound, aims only to obtain free drainage, and not the obliteration of the cavity. Under ether, and with the patient preferably in the sitting position, an incision is made through the skin similar to that adopted for most of the frontal sinus operations. It extends from about the centre of the unshaven eyebrow inward and downward for a short distance on to the other of the nose. After elevating the periosteum just above the brow, the sinus is entered by a gouge immediately above the base of the nasal process of the frontal bone. The opening should be enlarged with rongeur's forceps. A probe is now passed downward through the ostium of the frontal sinus and out of the nostril. Small curettes are passed from above downward through the floor of the frontal sinus always in front of, and external to, the probe at the

<sup>1</sup> Berliner klinische Wochenschrift, July 13, 1914, vol. li, p. 1322.

<sup>2</sup> Annals of Surgery, June, 1914, vol. lix, p. 937.

osteum. Excessive granulation tissue or polyps can be removed from the frontal sinus, but thorough curettement should be avoided. After a short time the bleeding from the sinus stops, and the vicinity of the osteum can be inspected. Further enlargement of the opening is done with burr drills introduced almost always through the nose, the cutting being done in front of, and internal to, the probe which is still in the osteum. This cutting is done by sight and is carried forward until only a bony shell is left anteriorly. When sufficient drainage cannot be obtained through the floor of one sinus, the other sinus should be entered and its floor removed in a similar manner, even if it is normal.

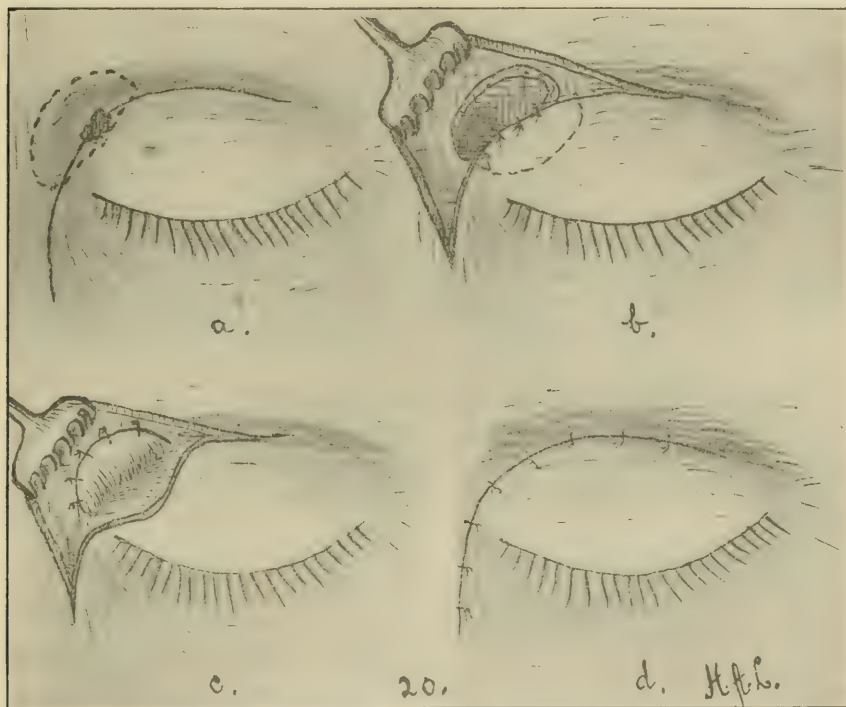


FIG. 10.—Lothrop's method of closing a frontal sinus fistula.

He says that it is practically impossible to infect a healthy mucous membrane when there is sufficient drainage as would be afforded by this operation. Although the two sinuses can sometimes be operated upon through a single opening, it is preferable to make a separate opening into each sinus.

Lothrop also proposes a rather unique procedure for the epidermization of the frontal sinus when there is an external fistula which has formed either spontaneously or as the result of a previous operation. This epidermization is accomplished as follows: After the osteum has been enlarged to as great an extent as the anatomy will allow, the

cut edge of the skin of the upper lid is sutured to the periosteum along the outer edge of the bony opening, which is generally through the orbital floor of the sinus. An oval incision is made in the lid down to the muscle fibers so as to form a flap about the size of the opening in the bone. The blood supply of this flap is good, and, being freely movable, it is easily turned upward to cover in the bone opening. It is now sutured along the upper edge of the bone opening with the skin side in, and the rest of the lid is drawn upward over it and sutured to the skin.

There is a great deal of thought being given to the *intranasal operation* in an endeavor to develop a technique which will obtain sufficient drainage and which at the same time is free from the danger of penetrating the cranial cavity. Groves<sup>1</sup> method of opening the frontal sinus is purely intranasal and attempts the complete removal of the nasal floor of the sinus. He removes the front half of the middle turbinal, chisels away the ascending ramus of the maxillary bone anterior to the insertion of the middle turbinal, and opens up all the anterior ethmoidal cells. After passing one of the soft metal protectors of Halle, he removes, with downward and forward cutting rasps, the bone in front of the protector which forms the medial portion of the floor of the frontal sinus. While he believes that no intranasal operation will entirely replace the radical, external operation, a large majority of the cases can be cured by the internal route.

Watson-Williams<sup>2</sup> says that when operative measures are called for in frontal sinus disease, an efficient intranasal operation is to be preferred to an external operation unless there are symptoms of cranial disease, bone necrosis or ocular complications. Also that there are many cases of frontal sinusitis which require no operation at all except, perhaps, an anterior middle turbinectomy. His present technique for the intranasal operation is as follows: With small angular ethmoidal forceps he engages the anterior margin of the middle turbinal at the point of attachment to the outer nasal wall. Cutting through this, the forceps enter the anterior ethmoidal cells in front of the frontonasal passage. Keeping to the outer side of the vertical plate of the ethmoid (the attachment of the middle turbinal), he clips away all the agger cells and the other anticonchal cells right up to the nasal crest. The anterior ethmoidal cells lying behind the frontonasal duct are also removed with forceps. One can readily clip the cells (as far back as may be necessary in any particular case) from the bulla to the sphenoidal sinus and this without anterior turbinectomy. Using the larger forceps, the thicker projecting partitions of the cells are safely punched away, as only the blunt tip of the female blade can come into contact with the roof. The bougies are then passed into the sinus so as to

<sup>1</sup> Wisconsin Medical Journal, August, 1914, vol. xiii, No. 3, p. 95.

<sup>2</sup> Journal of Laryngology, Rhinology, and Otology, May, 1914, vol. xxix, p. 17.

gauge the size of the frontonasal channel thus formed. The bony boss in the front of the frontonasal passage is reduced with a small, guarded burr until a large bougie can enter the cavity. Such a bougie measures 6 mm. wide and 8 mm. in the anteroposterior diameter. When the frontal sinus opening lies well to the outer side and tends to guide entering probes toward the orbital roof, unless contra-indicated by skiagrams it is well to draw the forceps or burr toward the front so as to enlarge the frontal osteum to the front and inward, rather than outward toward the orbital roof. With the small forceps which now enter freely, the projecting walls of any ethmoidal cells which remain may be clipped away to render the passage more free. The sinus is well lavaged at this stage and, finally, the anterior end of the middle turbinal may be removed, as when it is left intact the channel may be narrowed by subsequent granulation. Watson-Williams prefers this method of operating to either that of Mosher or Halle, because he avoids opening up a bare tract of bone so close to the cribriform plate, and always keeps intact the upper part of the vertical plate of the ethmoid formed by the attachment of the middle turbinate.

Halle<sup>1</sup> differs in his method of intranasal operations on the frontal sinus in that he turns down a mucoperiosteal flap from the side of the nose in front of the attachment of the middle turbinal. This removal of the soft part Halle claims gives a much better view of the structures to be attacked. Under local anesthesia, with a small, thin knife, an incision is made through the mucous membrane down to the bone beginning close to the nasal roof above the anterior end of the middle turbinal, and is carried downward around the insertion of the anterior end of the middle turbinal into the middle meatus. A second incision, starting at the upper end of the first, is carried downward and forward along the side of the nose to a point just above the pyriform aperture. A third incision starts from the lower end of the second and is carried across the nose to about the middle of the insertion of the anterior end of the inferior turbinal. The mucoperiosteum is now elevated, and the flap turned downward and backward. The ethmoidal cells are now opened by a chisel penetrating through the *agger nasi*, and cutting the anterior attachment of the middle turbinal. While this incision is preferably made with a chisel, it can be made with a strong pair of scissors. The turbinal is not removed but simply displaced toward the median line and left in position for orientation and for protection of the cribriform plate. A very clear field for visual inspection is now afforded, and the rest of the ethmoidal labyrinth can be opened up under direct control of the eye back to the sphenoidal sinus. The opening into the frontal sinus is found with a probe and enlarged anteriorly. For the removal of the floor of the frontal sinus, Halle employs

<sup>1</sup> *Archive f. Laryngologie und Rhinologie*, 1914, vol. xxix, Heft, 1, p. 73.

an electric drill with a blunt point the cutting part of which being larger at the point tapers gradually as it approaches the shaft. This tapering makes it impossible for the burr to cut except when being withdrawn. They are made in various sizes and the opening which admits the smallest is made with a Ritter's bougie.

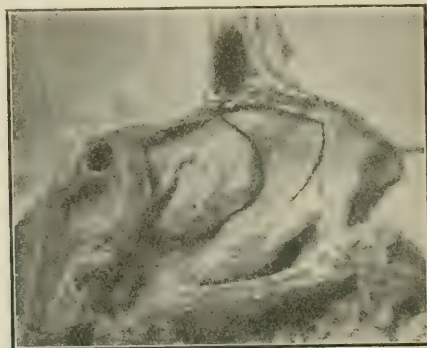


FIG. 11.—Halle's frontal sinus operation. Outline of mucoperiosteal flap.

Myles<sup>1</sup> says that he manages to avoid an external operation in over 90 per cent. of his cases. When, however, there is some brain or ocular complication, the Killian operation, or some modification of it, is advisable. When no attempt is made to do a complete obliterating operation, thorough or partial curettement of the sinus should be avoided, because free drainage and free ventilation are far better for an edem-

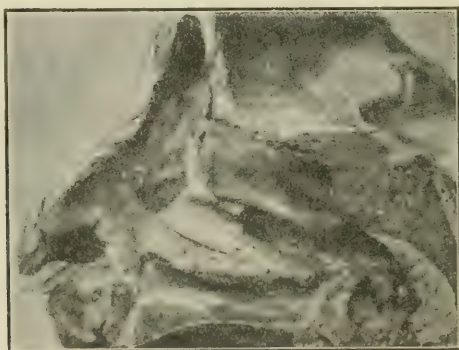


FIG. 12.—Halle's frontal sinus operation; mucoperiosteal flap turned down over the inferior turbinal and the floor of the frontal sinus removed.

atous and infiltrated mucosa than is a surgical mutilation. The use of drainage tubes of any kind are to be avoided as they tend to excite the formation of granulation tissue.

<sup>1</sup> *Annals of Otology, Rhinology, and Laryngology*, September, 1913, vol. xxii, p. 807.

Uffenorde<sup>1</sup> champions the orbital approach to the frontal sinus when doing a radical operation for the cure of chronic frontal sinusitis. He claims that it is not necessary to remove all the walls of the frontal sinus in order to procure complete obliteration of this cavity. He does, however, believe in the complete removal of the lining mucous membrane of the sinus but claims that this can be done through the floor of the sinus with properly shaped curettes. His results have been exceedingly satisfactory, so much so that he has never been able to examine a sinus once operated upon because he has never had to do a second operation on the same sinus. The Killian operation, however, is to be preferred in those cases of very deep cavities which make the curettement of the mucous membrane difficult or impossible when the floor alone is opened, and also in cases of intercranial complications. His method of operating is as follows: After elevating the soft structures from the floor of the sinus, he perforates the lamina papyracea just behind the lacrymal bone and resects a portion of the lacrymal bone and the processus frontalis as far downward as is necessary to thoroughly remove the infundibular and other ethmoid cells. The lamina papyracea itself is removed as little as possible so as to prevent the falling of the orbital contents into the nasal cavities, which would have a tendency to obstruct the communication between the frontal sinus and the nasal cavity. The floor of the frontal sinus is completely removed so as to permit the curettement to reach the extreme confines of the cavity. He closes the external route immediately and for the past few years has not even put on an external dressing. He generally inserts a strip of xeroform gauze from the nose into the frontal sinus, leaving it in place two or three days.

**Maxillary Sinus.** Watson-Williams,<sup>2</sup> while formerly advocating the extranasal operation for chronic antral suppuration, has now practically abandoned such methods in favor of the intranasal opening. He makes his opening into the antra more anteriorly than do most operators, removing the anterior portion of the antromental wall, not only below the line of attachment of the inferior turbinal but also for a short distance above it. The opening is carried posteriorly beneath the inferior turbinal as far back as may be desired. The opening of the anterior portion should be sufficiently large to permit the entrance of the little finger, so that the antral lining may be thoroughly palpated. As a rule he does not sacrifice the inferior turbinal except in very rare instances, though sometimes it is necessary to remove the extreme anterior portion in making the anterior upward extension of the entrance into the antrum.

This change of methods by Watson-Williams is in accord with the

<sup>1</sup> Beitrage zur Anatomie, Physiologie Pathologie und Therapie, 1914, vol. vii, Heft 4-5, p. 296.

<sup>2</sup> Journal of Laryngology, Rhinology, and Otology, March, 1914, vol. xxix, p. 113.

trend of events. The external method of operating on the antrum has practically been abandoned, and the opening generally made through the inferior meatus of the nose. Also there is a distinct tendency to avoid curetting the mucous membrane, as simply establishing an opening large enough for drainage and ventilation seems to bring as favorable results.

That serious **brain complications** can follow disease of the accessory sinuses has long been known. Recently there has been a good deal of feeling expressed that the frequency of these complications is much greater than has previously been supposed. Freudenthal<sup>1</sup> says there are four possible ways for infection to spread from the accessory sinuses to the brain: First, by continuity of structure; second, by way of the bloodvessels; third, by way of the direct lymphatics; and fourth, by way of the lymphatics in the sheaths of the olfactory nerves. To substantiate this lymphatic relation of the accessory sinuses to the cranial cavity, he quotes the following conclusions from Zwillinger's paper read at the last International Medical Congress in London: "1. The relation of the perimeningeal spaces of the subdural and subarachnoid space with the lymphatic network of the mucosa of the frontal sinus by way of the nasal mucous membrane in animals (rabbits) is a matter of knowledge. 2. The direct relation of the perimeningeal lymph spaces with the lymphatic network of the mucosa of the frontal sinus has been demonstrated. 3. The relation of the perimeningeal spaces with the lymphatic network of the mucosa of the frontal sinus by independent routes passing through the bones has also been determined. 4. Anatomical evidence of the relation of the lymph channels of the mucosa of the frontal sinus with the lymph spaces of the central nervous system in human beings has also been adduced. 5. The paths concerned in the occurrence of intercranial and cerebral complications of the frontal sinus comprise, besides those already known, the lymph channels of the mucosa of the frontal sinus which are in direct relation with the perimeningeal spaces."

As to the proof of the possibility of an infection gaining access to the cranial cavity *via* the lymph sheaths of the olfactory nerves, Freudenthal says that in a case of postoperative meningitis, Killian was able to macroscopically demonstrate the paths of infection from the ethmoid cells upward, although microscopical proof was lacking. The histological proof has but recently been afforded by Felix Miodowski at the clinic of Prof. Brieger, in Breslau. This was shown in three cases of submucous resection.

Freudenthal seems to take a rather pessimistic view of the possibility of the intercranial disease resulting from frontal sinus infection. He goes so far as to say that every operation on the frontal sinus has to be

<sup>1</sup> Laryngoscope, January, 1914, vol. xxiv, p. 12.

considered as dangerous, and also that a large number of acutely diseased sinuses ought to be radically opened because of the danger of intercranial disease. Freudenthal's own statistics show six cases of death out of one hundred and fifty operations. He believes that it requires a great deal of judgment on the part of the surgeon to say when the sinus ought to be operated upon and when not.

It is probably on account of the danger attending the external frontal sinus operation, when it is as extensive as that done by the Killian method, that many surgeons are trying more conservative methods and are endeavoring to develop a safe technique for the intranasal procedure. I can scarcely believe that there are any great number of acute sinus infections that require a radical operation, although occasionally one does occur and the operation is especially indicated when there is any evidence of an osteomyelitis or symptoms of brain involvement.

A rather interesting series of cases demonstrating the possibility of involvement of the cranial cavities from disease of the nose are reported by Gerhardt.<sup>1</sup> Four cases of serous meningitis following nasal infection are reported. The first two cases show distinct evidence of brain pressure, and lumbar puncture showed that the cerebrospinal fluid was greatly increased and under heightened pressure. In both of these cases there was purulent disease of the accessory sinuses, and the opening up of these cavities caused the general symptoms of brain pressure to rapidly subside. In the last two cases reported there was no suppuration, only a retention of mucoid secretion in the cells. In one of these latter cases there was papillary edema, while in the other the diagnosis was made by lumbar puncture. These cases likewise cleared up after an operative attack on the accessory sinuses, although in one there was a history of repeated trauma, and in the other of chlorosis. While he is firm in his belief that the serous meningitis was in these cases a direct result of the nasal condition, he does not understand just how the inflammation spread from the nose to the meninges. There was some doubt in his mind as to whether there was a penetration of the microorganism itself or whether the increased intercranial pressure was simply a so-called collateral edema spreading from the inflammation in the nose. While the cerebrospinal fluid was free from albumin, globulin, and any increase in the number of cells, he argues that this does not absolutely rule out microorganisms as these parasites may have been quickly eliminated, leaving behind them only a low degree of inflammation. However, it must be admitted that the condition of the cerebrospinal fluid as found, made the possibility of bacteria being present very improbable. Also his idea as to the method of a collateral edema spreading from the nose into the cranial

<sup>1</sup> Zeitschrift f. Laryngologie, Rhinologie und ihre Grenzgebiete, 1913, Band vi, Heft 5, p. 721.

cavities is rather vague. He believes that the number of cases of meningitis of nasal origin is much greater than a review of literature would seem to indicate. It is important for the practitioner to bear in mind that in certain cases of acute or chronic serous meningitis, the cause may be found in the nose or its accessory sinuses and that, when these cases are properly operated upon, the symptoms will probably disappear.

An almost unique case in the history of nose and throat literature is one reported by Chamberlin.<sup>1</sup> The case is of interest especially on account of the great destruction which can take place as a result of sinus disease and polypi without the production of severe symptoms. A man, forty-one years of age, had a history of old chronic sinus disease. He frequently had numerous polypi removed from the nose, and, when examined, he had exophthalmos of the left eye and a discharging fistula through the upper lid. At the operation the frontal sinus was found filled with polypi. The whole posterior wall of the sinus was lying free and perfectly movable and, when taken away, there was found behind it large masses of polypi occupying the anterior cerebral fossa. The amount of polypi removed measured about  $\frac{1}{4}$  liter. After their removal it was found that the cavity left by them involved almost the entire anterior cerebral fossa on that side. The cavity showed little tendency to contract as, even after the patient had gone back to work, it measured 5 cm. deep. In this case there had been no history of headaches or any form of paralysis, and the mentality was at all times good.

**Cavernous Sinus.** Among some of the larger operations that have been attempted by nose and throat specialists during the past year is the attack on the cavernous sinus. Mosher<sup>2</sup> has developed a technique on the cadaver and has operated on one patient. However, in this case, he failed to strike the sinus, but believes that improvement in the technique will make the operation a fairly accurate one. The operation is described by Mosher, as follows: "The globe of the eye is removed and the orbital contents cleaned out. The ophthalmic artery is tied. Then the periosteum is cleaned from the posterior half of the floor of the orbit and the groove looked for in which the superior maxillary nerve runs. The next step is to separate the periosteum from the orbital surface of the great wing of the sphenoid and to recognize the outer end of the sphenoidal fissure. With the chisel placed vertically, a cut is made through the orbital plate of the great wing of the sphenoid from the notch of the superior maxillary nerve below the outer end of the sphenoidal fissure above. The bone is thin along this line and is readily removed. It is important to make sure that the whole of the bone making the lower border of the fissure is taken away. The bone opening

<sup>1</sup> Laryngoscope, October, 1913, vol. xxiii, No. 10, p. 982.

<sup>2</sup> Ibid., August, 1914, vol. xxiv, p. 709.

is enlarged outward one-half centimeter with either rongeur or chisel. The lower edge of the bone window should be brought flush with the floor of the orbit. Unless this is done it is not easy to get to the bottom of the middle fossa from which the dura is to be elevated. If the window is carried further outward, the zygomatic fossa is opened. The bone is so thick where the orbital plate makes the apex of the zygomatic fossa that the approach to the middle fossa and the cavernous sinus, by removing first, as I did on the living, the malar bone by the method of Kroenlein and then attacking the orbital plate from without inward, starts the operation on thick bone and makes the exposure of the dura slow. Consequently the operator becomes timid. Furthermore, there are no landmarks by which to make the bone incision; so the operator may easily, as I did, go too high and enter the anterior, instead of the middle, fossa. By making the bone incision as has just been described, that is, from the groove of the superior maxillary nerve upward to the outer end of the sphenoidal fissure, the orbital plate of the great wing of the sphenoid splinters off in much the same fashion as the bridge comes away in a radical mastoid operation with the last stroke of the chisel. Having quickly uncovered the dura, the operator goes on confidently."

"The bone window being made and enlarged outward and brought flush with the floor of the orbit, the dura is then elevated from the floor of the middle fossa, working from the outer boundary of the bone window inward. On the cadaver, the dura can be separated from the outer wall of the cavernous sinus for a distance backward for about one centimeter. Then the separation becomes hard. If the elevation is persisted in at the level of the bottom of the bone window, a pin-head opening is torn in the outer wall of the sinus at this point. I do not know whether this is due to dividing a vein running in the outer wall of the sinus, or whether a strand of one of the nerves in the outer wall of the sinus is torn away. Above and beyond this point of adhesion between the outer wall of the cavernous sinus and the dura, the two can be separated for about one centimeter further. Then the emergence of the ophthalmic division of the fifth nerve from the Gasserian ganglion halts the separation. If the attempt is made to separate the inner wall of the cavernous sinus from the outer wall of the body of the sphenoidal bone, the knife may have to be used to start the separation, but once it is started it can be carried back easily to the limit of the sinus."

"Experimentation makes me feel that the exposure of the outer wall of the sinus, though limited in extent, is the better. Choosing then the exposure of the outer wall of the sinus and having separated the dura from it for one centimeter, a blunt pointed knife is placed against the outer wall of the sinus on a level with the floor of the orbit and the knife blade carried forward toward the body of the sphenoid until it is stopped by the bone. This incision opens the wall of the cavernous

sinus for one centimeter and is well below the internal carotid artery. Through this incision into the cavernous sinus, a small curette can be carried back in the sinus to the opening of the superior and inferior petrosal sinuses, that is through the whole body of the sinus. The distance from the rim of the orbit is, on an average, between 3 and 4 $\frac{1}{4}$  inches."

"Given a cavernous thrombosed or full of pus, what would happen in life in my opinion is, that as soon as the separation of the dura from the outer wall of the sinus was begun, the sinus would rupture. The escaping pus would then guide the curette into the cavity of the sinus."

"The above operative technique is based upon one failure in the living, to which I owe much, and to which I hope some day one of you will owe something, and to ten operations on the cadaver. I believe that it is entirely feasible, and that it is something more than a cadaver operation with which the demonstrator caps his operative course and stirs the imagination of the post graduate student. Its drawback is the necessary removal of the eye. In serious cases, because there are cases which get well without operation, when a reasonably sure diagnosis can be made, the eye is already useless. The patient without operation is doomed. As I look at the question of the sacrifice of the eye, both scripture and surgical sense call for it."

As opposed to Mosher's method of reaching the cavernous sinus, Pooley<sup>1</sup> recommends the external route, as suggested by Dwight and Hartley. Pooley believes that thrombosis of the cavernous sinus is distinctly an operable condition. In considering the technique of the operation, as done by Dwight and Hartley, three points are to be considered. First, the sinus will be found most approachable from the temporal side, therefore the opening in the skull should correspond precisely with the one which would be made for exposure of the Gasserian ganglion. Second, the difference in the two operations consists mainly in the fact that in exposing the ganglion the operation is extradural, whereas in the exposure of the sinus it is imperative to make the dural incision, and to approach the sinus in the space between the base of the brain and the dura. The incision in the dura should be made on a level with the base of the skull when the brain can be easily elevated. Once the sinus is reached, it should be opened and the thrombosis thoroughly removed with a curette. Pooley says that Dwight has shown that an incision into one sinus instantly relieves the circulation in both. The operation can be done without a great deal of difficulty, is not associated with any degree of shock, is not a lengthy procedure, and hemorrhage is easily controlled. In one case of Hartley's which Pooley details, there was a septic thrombosis of the cavernous sinus following a traumatic orbital sarcoma. The sinus was thoroughly

<sup>1</sup> New York State Journal of Medicine, August, 1914, p. 398.

curetted and the patient lived for forty-seven days after the operation, dying from general septicemia, consequent upon the sarcomatous condition.

It would seem that the operation of Dwight and Hartley is a much preferable method of attacking the cavernous sinus than that of Mosher, if for no other reason than for the fact that Mosher necessarily sacrifices an eye in gaining access to the region of the sinus. Also the difficulty in exact orientation seems to be greater with the Mosher operation than it does with the external route, and the time involved in the preparation of the field is a distinct disadvantage in the Mosher technique.

### THE TONSILLAR TISSUES.

**The Relation of the Thyroid Gland to the Resistance of the Individual Against Poison**, either chemical or bacteriological, is, thanks to a large amount of scientific research, becoming well established. Recently it has been shown that thyroidectomized animals are more susceptible to bichlorid poisoning than normal animals, and also that the administration of thyroid gland will increase the functions of the leukocytes and raise the opsonic index of the blood, while the removal of the gland distinctly lowers them. Beebe<sup>1</sup> has taken up the question of the relation between pathologic conditions of the nose and throat and hyperthyroidism. He says that thyroid disturbances occur most frequently in persons of a thymico-lymphatic constitution, and it is these individuals who are most susceptible to infection. The terminal event in hyperthyroid patients is not infrequently an infection which has begun in the tonsil, and he says he has not seen any necropsy in these instances which did not disclose the characteristic pathology of a status lymphaticus. A large percentage of patients with exophthalmic goitre have enlarged tonsils and adenoids. They give a history of repeated attacks of acute tonsillitis. Not infrequently one or more of the accessory sinuses are, or have been, infected. It is not uncommon to date the beginning of the thyroid enlargement from a particularly severe attack of tonsillar infection. For some time Halsted has recognized that there is evidently some relation between wound infection and thyroid hypertrophy. Quervain, Bircher and Gaylord have further confirmed the theory of the origin of thyroid hyperplasia being due to infection. While infections do not cause enlargement of the thyroid gland in the larger percentage of cases, it is very possible that, when the balance of the glands of internal secretion is not quite normal, the stimulation to overactivity by an infection may, when sufficiently repeated, cause hyperplasia of the thyroid gland. Clinically, there is an important relation between the infections of the nose and throat and hyperthyroid-

<sup>1</sup> Journal of American Medical Association, August 29, 1914, vol. lxiii, p. 769.

ism. Recurrent attacks of tonsillitis, hypertrophied faucial and pharyngeal tonsils, accessory sinus disease may all act as a source of infection which causes an increased activity of the thyroid glands with hyperplasia. While in the beginning the tonsillar infection may be the exciting cause that leads to the increase in the thyroid gland, subsequent attacks of tonsillitis after the gland is enlarged are exceedingly dangerous and troublesome. The relief which follows the elimination of sepsis, whether in the sinuses, nasopharynx or tonsils, is usually so prompt and effective that one has little doubt as to its cause or its relation to the overactive thyroid, and consequently it is more logical to attack the infected area than to attempt any action on the thyroid. By so doing many patients may be permitted to retain the gland for a useful function. In operating in these cases, however, one must be careful not to operate during an attack of hyperthyroidism.

In my own mind there is little doubt that in many cases of enlarged thyroid gland and even in exophthalmic goitre, the condition can be distinctly improved by attention to the tonsillar tissues, not that the tonsillar tissues are in any direct relation with the thyroid gland, but that they are frequent sources of infection and that the infection is the exciting cause, as stated by Beebe, of the thyroid hyperplasia.

A large exhaustive survey on the *anatomy* of the faucial tonsils by Grunwald<sup>1</sup> is extremely interesting, in that it presents a definite scientific basis for the anatomical variations of the faucial tonsils. Those especially interested in this side of this subject will be repaid for a careful perusal of the original article as the space in this review will permit of only a brief abstract of the more striking features.

In the third fetal month a fold develops in the substance of the second branchial arch running upward and backward. This fold later develops into the arcus palatoglossus, forming the upper anterior boundary of the tonsil groove. The posterior boundary is made by a downward extension from the processes palatinus of the upper jaw developing from the first branchial arch. This fold later forms the arcus palatopharyngeus. Soon after the establishment of these relations the tonsil formation begins. The first evidence of tonsil tissue is the inward growth of epithelium into the lateral palatal pouch bounded by the folds as described above. The further development of the tonsillar anlage is similar to that of the thymus, so that Grunwald looks upon faucial tonsils as incomplete distorted thymus glands and this especially so as comparative anatomy bears out the simile. As to the gross anatomy of the tonsil, he describes the formation somewhat differently than do the majority of authors. The tonsil fossa is divided into two portions by a transverse fold called the plica transversa. The upper part of this division is smaller and deeper and is called the fossa tonsillaris; the

<sup>1</sup> Archiv f. Laryngologie und Rhinologie, Band xxviii, Heft 2, p. 179.

lower one, larger and shallower, is called the sinus tonsillaris. The tonsil develops in two portions, the upper and lower, the upper occupying the fossa tonsillaris, and the lower the sinus tonsillaris. The

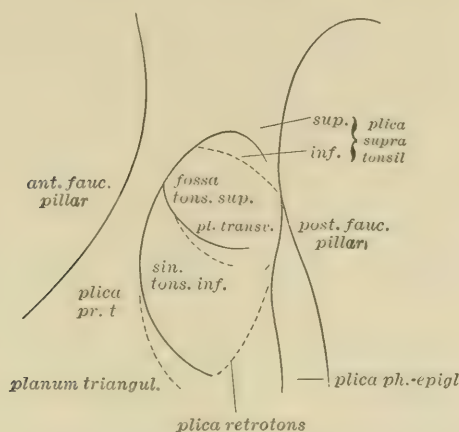


FIG. 13.—Diagram of tonsillar folds according to Grunwald.

*plica triangularis* of Killian, Grunwald terms the *planum triangularis*, while the continuation of the fold up over the tonsil he calls the *plica pretonsillaris*. He retains the term *plica supratonsillaris* for the edge of the mucous membrane fold covering the top of the region of the

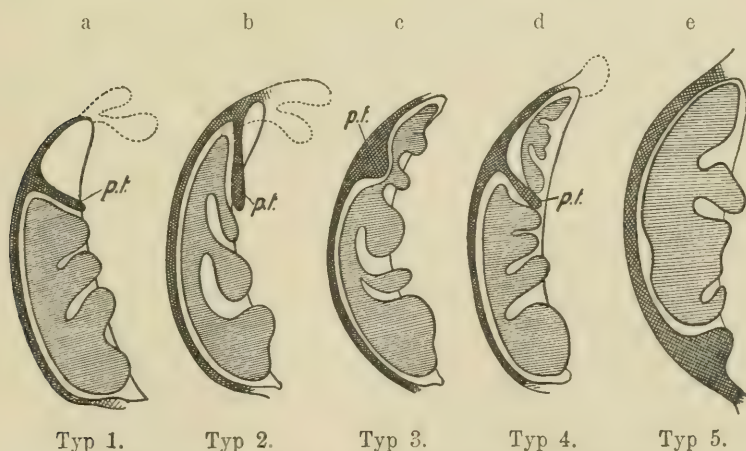


FIG. 14.—Diagram showing type of tonsils dependent upon the development of the plica transversus (*p.t.*).

tonsillar fossa. According to this description, there is no supratonsillar fossa, the so-called supratonsillar fossa being the fossa tonsillaris, bounded below by the plica transversa. The further development of

the tonsil is absolutely irregular, and the variations in appearance depend upon whether the development involves chiefly the inferior or superior tonsil. Possible variations of the tonsil in size and shape are so numerous that it is impossible to do more than refer the reader to the article.

Grunwald calls attention to the necessity of retracting the plica pretonsillaris in the examination of all tonsils, and also to the searching of all recesses and crypts with a probe. Concerning the capsule of the tonsil, he says that the capsule is intimately connected with the parenchyma of the tonsil, and, therefore, an intracapsular operation is not feasible when an attempt is made to remove the whole tonsil. On the other hand, in the majority of cases the capsule can be cleanly separated from the surrounding structures on the outside, but not in every case as sometimes some of the fibers of the palatopharyngeus, palatoglossus and superior constrictor muscles are intimately blended with the outside of the capsule. This latter fact explains why, in certain cases, in spite of all precaution, muscle fibers are found attached to the outside of the tonsil after enucleation.

From a histologic study of enucleated tonsils, Wyatt Wingrave<sup>1</sup> says that always, when a tonsil is enucleated, muscle fibers can be found attached to the capsule, because there is an intimate connection between the tonsil and the muscular bed on which it rests. The muscle fibers are not sharply separated from the tonsil by aponeurotic tissue, but actually extend into the tonsil itself. The muscular extension is usually avoided in partial removal by guillotine, but is disturbed during enucleation. He believes that exposure of these muscle bundles may afford a ready channel for infection of the deep cellular spaces.

While in a great many enucleations muscle fibers can be seen on the extirpated capsule, I do not believe that a cutting of a few such fibers is at all harmful nor does it, as a practical happening, open up any pathway for a serious infection.

**The Pathology of the Tonsillar Tissues** of the throat is an extremely interesting and important subject and it is unfortunate that more and better work has not been done in this line of investigation. There are many who hold that the faucial tonsils must always be looked upon, when enlarged, as diseased structures. They are probably not far from right in that the large majority of tonsils, if examined carefully throughout their whole extent, will show, in some portions, isolated areas of inflammation, either in the cryptal walls or in the parenchyma of the tonsil itself.

Willis<sup>2</sup> makes a rather brief report of his findings after a macroscopical and microscopical examination of 213 tonsils removed from 108 cases. Cryptal concretions were present in 154; so-called abscesses in 30, and pericryptal inflammation in 165, while distinct evidence of tuber-

<sup>1</sup> *Journal of Laryngology, Rhinology and Otology*, April, 1914, vol. xxix, p. 181.

<sup>2</sup> *Southern Medical Journal*, September, 1914, vol. vii, p. 746.

culosis was found in 5 per cent. In relation to the latter condition, it is interesting to note that in all of these cases of tuberculosis there was a cervical adenitis on the same side in every case except one.

It is well known that the crypts of the faucial tonsils frequently harbor various pathogenic bacteria. Another organism has been added to the list of those found in the tonsillar crypts by the discovery of Smith, Middleton and Barrett<sup>1</sup> who found the ameba of Rigg's disease, the *endamoeba buccalis*, in 5 out of 17 cases examined. These 17 patients all showed some type of chronic tonsillitis with tonsillar hypertrophy. The tonsils of the 5 persons in whom these organisms were demonstrated were all large, with pouting crypts, and were removed from young persons presenting the usual general and local symptoms of chronic tonsillitis with irregularly occurring exacerbations.

The importance of the tonsillar tissues of the throat to cryptogenic infection has, like many other important medical questions, not yet reached solution. We specialists remove tonsils because we believe the patients will be benefited by their removal but in many cases it is just a matter of belief, not of certainty. While certain individuals who call themselves conservatives are endeavoring to credit the tonsil with important functions and to discount the advisability of its removal, the general practitioner is forcing upon us as specialists an ever increasing number of operative cases. This is because the general practitioner is recognizing the fact that the tonsils are frequently of serious etiologic importance to the general welfare of the patient.

Sometimes the radical conservative develops an idea usually old, occasionally new, and succeeds in backing it with sufficient clinical or experimental data to attract attention. The chief criticism in general of this kind of work is, that the author almost always attempts to substantiate, by his observations and experiments, preconceived ideas. From the first he is biased and does not impartially look out for technical errors nor balance judiciously conflicting facts. A very important result, however, is that such work may force others to prove or disprove it. Hence, there is added much to our scientific knowledge. The general practitioner is the index of achievement. If he had been forced by clinical results to believe that tonsils are better out than in, we should be very slow in accepting any data which must, if believed in, radically alter the trend of events.

There appears in the *Archiv f. Laryngologie und Rhinologie*, 1914, Heft, 2, p. 231, an article by Henke, a well known and supposedly reliable investigator. He takes up the defence of the tonsils claiming that they are important organs of exceeding value to the human economy. After a criticism of supposed facts and plausible theories pub-

<sup>1</sup> Journal of American Medical Association, November 14, 1914, p. 1746.

lished in German literature, in which criticism he takes sides against a great number of investigators, including such men as Hendelsohn, Lexer and Goodale, he details a rather remarkable series of experiments. The first experiments concern the feeding of rabbits with a large quantity of carbon and chinese ink. In none of the tonsils of these rabbits was he able to find, even microscopically, any evidence of absorption through the crypts. This series of experiments confirmed his belief, in spite of all the previous work to the contrary, that it is not possible for the tonsils to absorb from the surface. He says that neither Lexer nor any other investigator has succeeded in producing a suppurative tonsillitis which would lead to a general infection. Also he says that the various authors not only do not prove that the normal tonsil is a vulnerable organ to outside infection, but that the evidence so far seems to be just the opposite. Henke then experimented by injecting insoluble pigments, such as soot and chinese ink, into the mucous membrane of the nose of living animals. The tonsils removed from these animals, at various periods of time after injection, showed the presence of the pigment. In a series of experiments upon human beings, he made injections of sterile suspensions of soot, into the various parts of the nasal fossa. The tonsils were removed from these persons in from six hours to six days after the injection. These injections were always made with the consent of the patient, and never produced the slightest harm. He found that in twenty-four hours after such injections, both the faucial and pharyngeal tonsils showed the presence of pigment. In examination of the tonsils, it sometimes required a large series of sections before the pigment was found. From the deposition of the pigment he believes that he has established a direct lymphatic relationship between certain portions of the tonsils and certain portions of the nose. The particles were found in all the layers of the tonsils, that is in the epithelium, sub-epithelial tissue, in the lymph spaces and lymph vessels, in the tonsillar lymph sinuses, in the perivascular lymph spaces and around the follicles, rarely in the centre of the follicles and never in the lumen of the bloodvessels. Similar injections into the gums gave similar results. He deduces from these experiments that he has established an anatomical fact of a direct lymph connection, not only between the nose and the tonsils but also between the gums and the tonsils. He further found that carbon particles do not remain for any length of time in the tonsils, and believes that they are eliminated through the crypts as a result of a lymph stream passing outward through the tonsils. He says that the leukocytes play a very unimportant part in this elimination. He also found the particles in the tonsils where the injections had been made in the gums after death. As a result of this work, he believes that the tonsils have the following functions: They are similar to the lymph nodes in that they act as a filter for the lymph stream; they differ, however, from the lymph nodes in that they present

on one side a free surface through which the open mouths of the crypts afford to the organisms an exit for foreign elements which are brought to the tonsils by way of the lymphatics. He says that tonsillitis is caused by virulent organisms being carried to the tonsil parenchyma by the lymphatics, and is rarely, if ever, due to a surface-infection. Further, that tonsillitis occurring in joint rheumatism, endocarditis, and general sepsis, etc., is the result of, and not the cause of, the general condition.

It is somewhat startling to read this article as it apparently upsets all of our previous knowledge concerning not only the physiology but also the pathology of the lymphatic tissue of the throat, and, further, makes the careful and stupendous amount of clinical observations merely a matter to show how prejudiced we medical men may at times be.

My personal feeling was that I could not accept the results of his experiments or his deductions, but recalling that Schoemann, and especially Lenhart, had obtained somewhat similar results, their side of the question seemed to present evidence of a confirmative nature so that the subject began to appear as though it needed the light of further investigations. However, just recently Karl Amersbach,<sup>1</sup> stimulated apparently by Henke's work, published the results of his own experiments carried out in nearly the same manner as Henke's except that he was more careful in the method of his injections. The injections were made in such a way as to prevent any excess of material gaining access to the surface of the mucous membrane, thus making it impossible for a surface inoculation of the tonsil to take place. His experiments on human beings, seventeen in number, gave results similar to Henke's in only one particular, and that was that these injections caused no harm to the patient. When the injections were made into any portion of the mucosa, except directly into the tonsil, the carbon particles were never found in any portion of the tonsil. In four of his patients the injections were made into the tonsil itself, and, in contradistinction to the deductions of Henke, he found no evidence to show that the particles were being carried through the parenchyma of the tonsil toward the surface. In his animal experimentations, sixteen dogs were used. In these dogs in which the carbon particles were injected into the turbinates of the nose, the tonsils were found to be absolutely free and the foreign particles followed the regular established lymph current and in every case were found in the sub-maxillary lymph nodes and in such great quantity as to give a distinct macroscopical discoloration. In one dog in which the carbon was injected into the tonsil itself, the pigment was found in the retrotonsillar tissue, being carried in the opposite direction to that in which Henke claims the lymph current flows. Amersbach absolutely opposes Henke's view and

<sup>1</sup> *Archiv f. Laryngologie und Rhinologie*, 1914, Heft 1, p. 59.

believes that the latter is guilty of faulty technique, and that, assuming the correctness of his observations, the fact that he found only a small quantity of pigment in the isolated portions of the tonsils is more indicative of a surface absorption than a lymphatic inoculation.

In estimating the value of these two articles, we must give by far the greater amount of our own experience to the results of Amersbach's as opposed to those of Henke. Our knowledge of the lymphatic connection of the nose and throat have been worked out in great detail by the best anatomists in the world and there has never been any anatomical evidence produced to show that the tonsils are in any way connected with the mucous membrane of the nose or gums except that such communication has been intercepted by one of the lymph nodes of the neck, with one possible exception; the collective lymphatic trunk from the nasal fossæ passes around the pharynx, turning sometimes into the subparotid lymph nodes or occasionally joining with a collective trunk from the region of the pharyngeal tonsil and emptying into the lymph nodes of the posterior division of the deep cervical group. Amersbach's experimentations show that the carbon particles were carried from the nose by the already established lymphatic route and deposited in the submaxillary glands where, *a priori*, they should go.

Opposed to Henke's view that the tonsils are organs of elimination, and that disease of these organs are very rarely, if ever, caused by surface infection, is arrayed a long list of anatomical research, established facts both bacteriological and pathological and a vast amount of clinical observation. And this array has been substantiated by experimental research. In the first place, as far as we know, there are no afferent lymph vessels running to the parenchyma of the tonsil and the tonsils do not possess perilymphatic spaces, such as we find in the lymph nodes. The peculiar anatomy of the epithelium of the tonsillar crypts offers mechanically a less perfect barrier against infection than does the surface epithelium. We know from pathologic studies that in acute tonsillitis the attack is first directed against the epithelium of the crypts, and that the parenchyma is only involved when this barrier has been destroyed by the toxic action of the microorganisms. There are a few microorganisms which will pass from the surface inward through the unaltered cryptal epithelium and gain access not only to the parenchyma of the tonsil itself but also to its efferent lymphatics and regionary lymph nodes. Among such microorganisms are found the tubercle bacillus in man, and the anthrax in hogs. Clinically, we know that a descending tuberculous cervical adenitis may originate from a latent lesion of the tonsil; that the removal of tonsils frequently clears up a systemic infection, such as rheumatoid arthritis, and that endocarditis, nephritis, and other septic conditions follow after an acute attack of tonsillitis and were not present when the attack of tonsillitis began. Experimental work by men who stand high, not

only in this country but abroad, give conclusive evidence that inert foreign bodies under certain circumstances may pass through the crypts, through the cryptal epithelium, and gain access to the efferent lymph channels.

**Tonsil Operations.** Ernest Winkler<sup>1</sup> says that in making a choice of operative procedures on the tonsils, *complete enucleation* meets the requirement and gives better results even in children than does partial removal. He calls attention to the importance of removing embedded tonsils which lie high up in the palate, because, by raising the floor of the vault, they interfere with nasal breathing, so that removal of the pharyngeal tonsil alone fails to free the nasopharynx. A further series of examinations were made to determine whether the tonsils are concerned in the blood supply. This was done by testing for hemoglobin just before the operation and again five to twelve months afterward. He found that, with only one or two exceptions, there was a distinct gain in the hemoglobin percentage after the operation, and therefore believes that the tonsils have very little to do with the blood supply.

In this regard, however, and as Winkler remarks, the tonsils cannot possibly be classed among the organs manufacturing red blood cells, but there is very good histologic evidence to show that they are centres of increase for the lymphatic cells. The increase in the hemoglobin percentage noticed by Winkler was probably due to the improvement in the health of the child and had nothing whatever to do directly with the tonsillar tissues. In another series of experiments which were carried out by Kerber at Winkler's suggestion, it was found that patients who had suffered from suppurative conditions of the tonsils showed the presence in their blood of a protective ferment specific for tonsillar tissue.

This application of Abderhalden's dialysation method is rather interesting but of little actual value, especially as more recent research has tended to discredit the value of the method itself. Leitch,<sup>2</sup> after a prolonged study of cases both of pregnancy and of cancer, believes that the method is without diagnostic value, because the real fallacies of technique are beyond control and also it is likely that there exists in the serum a general proteolytic and peptolytic ferment which can be demonstrated by adding a suitable, though not necessarily a specific, protein or peptone.

As a result of his work, Winkler believes that enucleation of faucial tonsils in children is not any more harmful than in adults, and that, when operating on the structures, it is essential that all of the diseased tissues should be completely removed.

The operation of tonsillotomy, or the partial removal of tonsils,

<sup>1</sup> Beiträge zur Anatomie, Physiologie, Pathologie und Therapie des Ohres, etc., July, 1914, Band vii, Heft, 6, p. 450.

<sup>2</sup> British Medical Journal, August 15, 1914.

has been practically superseded by tonsillectomy, the complete enucleation. There are still, however, a few men who believe that tonsillectomy in children, that is, under three years of age, is to be avoided, if possible, and, when an operation on the faucial tonsil is required, tonsillotomy ought to be done. Dickie<sup>1</sup> says that while tonsillectomy by means of the guillotine is not a more serious operation than tonsillotomy in children under three years of age, tonsillotomy is preferable. On the other hand, tonsillectomy should be the operation of choice in all children over five. His recommendation for the partial operation on children under five is on account of his belief that the tonsils have some function in early life, though as to its nature he is very much in the dark.

Harrison<sup>2</sup> believes that tonsillectomy is always the preferable operation, because tonsillotomy may leave a condition which requires a subsequent operation, and the portion of tonsil being left behind is liable to septic infection and, also, a partial removal of the tonsils may actually set up a series of attacks of tonsillitis. Further, in removing a possible tuberculous tonsil there is the great danger of cutting through a tuberculous nodule which may result in a dissemination of the disease.

Tenzer,<sup>3</sup> in examining a number of children whose tonsils had been removed at least two years previously, found nothing to indicate that tonsillectomy was followed by any deleterious influence. The result, as far as abolishing recurring attacks of acute tonsillitis, was ideal, and all of the children showed marked improvement in health.

I have no hesitation in saying that when an operative attack is to be made on faucial tonsils these structures should be removed by a complete enucleation, and this is the consensus of opinion of the leading laryngologists in this country. The chief debate at present is on the method of enucleation. Probably the greater number practice some form of dissection followed by the cold wire snare, though there are an increasing number who use Sluder's method or some variation of it.

Probably the greatest danger of a tonsil operation is hemorrhage, and in this connection we read with interest the investigations of J. Leslie Davis<sup>4</sup> concerning the blood supply of the tonsils. He says that there are certain fixed sources of all hemorrhages from tonsillectomy operations and that the majority of text-books are false as to the anatomy of the bloodsupply of the tonsils. He says that the entire blood supply of the tonsil comes from one artery which is formed by an anastomosis of the ascending palatine branch of the facial and the descending branch of the internal maxillary. The artery thus formed enters the fossa at its superior extremity, passes downward through the capsule

<sup>1</sup> *Journal of Laryngology, Rhinology, and Otology*, April, 1914, vol. xxix, p. 184.

<sup>2</sup> *British Medical Journal*, February 21, 1914, p. 421.

<sup>3</sup> *Wiener klinische Wochenschrift*, November 20, 1913, vol. xxvi, No. 47.

<sup>4</sup> *Laryngoscope*, March, 1914, vol. xxiv, p. 161.

for the distance of about one-half an inch before penetrating the capsule to reach the tonsil parenchyma. He believes that this is the sole blood supply of the tonsil and that the tonsillar branch of the facial artery, the branch from the *dorsalis linguæ*, and the branch from the ascending pharyngeal supply only the surrounding structures, at least such is the case in 95 per cent. Acting on this idea of the anatomy, after an enucleation of the tonsil Davis passes a suture ligature of No. 1 catgut around the artery in the upper part of the tonsillar fossa and then ties it off. He does this routinely when he enucleates in adults, whether there is profuse bleeding or not, but in children this process is carried out only if there is profuse bleeding which does not stop in a few minutes.

From my own experience with tonsillar hemorrhage, which has been considerable, I cannot accept Davis's idea that serious bleeding always occurs from the upper part of the tonsillar fossa. In fact I have seen very few cases where bad hemorrhage did occur from the upper part of the fossa, and, when the bleeding was from arteries in this position, it was easily controlled. The most serious hemorrhage which I have seen and which has given me the most trouble to stop was apparently from a branch of the *dorsalis linguæ* coming out of the mucous membrane close to the side of the tongue. When the hemorrhage occurs from this position it is most difficult to control, as it is generally impossible to pick up the bleeding point with forceps or to pass a ligature around the artery. In my own anatomical preparations I found that the largest artery to the tonsil was usually the tonsillar branch of the facial, which Davis says does not supply the tonsil proper but only its mucosa.

Glas<sup>1</sup> agrees with Davis in that severe bleeding is more apt to occur in the upper or middle part than from the lower pole of the tonsil, whereas McKinney<sup>2</sup> says that in his cases the bleeding was every time from the inferior lobe of the tonsil.

While the removal of the hypertrophy of the *pharyngeal tonsil* is one of the most common surgical operations done, there seems to be some dissatisfaction as to a clean routine method for this operation. This is shown by the number of instruments that are on the market; forceps, curettes, guillotines, snares, etc., also because we frequently see new methods being published which, however, are generally slight modifications of old procedures. Beck<sup>3</sup> has revised an old idea under a new technique which may be a help in the removal of adenoids. He retracts the soft palate by passing a small rubber catheter, one end of it through each nostril and then brings the two ends out of the mouth, where they are held by an assistant. The palate can now be so far retracted as to afford direct inspection of the lower part of the mass,

<sup>1</sup> Medizinische Klinik, June, 1914, vol. x, p. 1005.

<sup>2</sup> Journal of Tennessee State Medical Association, vol. vi, No. 7, p. 270.

<sup>3</sup> Surgery, Gynecology, and Obstetrics, July, 1914, p. 98.

and, if a large laryngeal mirror be used, then the posterior choanæ and the extreme lateral aspects of the nasopharynx are easily brought to view. For the removal of the adenoids, he employs a curette of the St. Clair-Thompson pattern but without a guard and with the cutting edge formed into a wavy blade. The motion of the instrument in the removal of the mass is not in the usual rapid down stroke of elbow wrist but of a sort of see-saw from side to side and with a slow elbow-

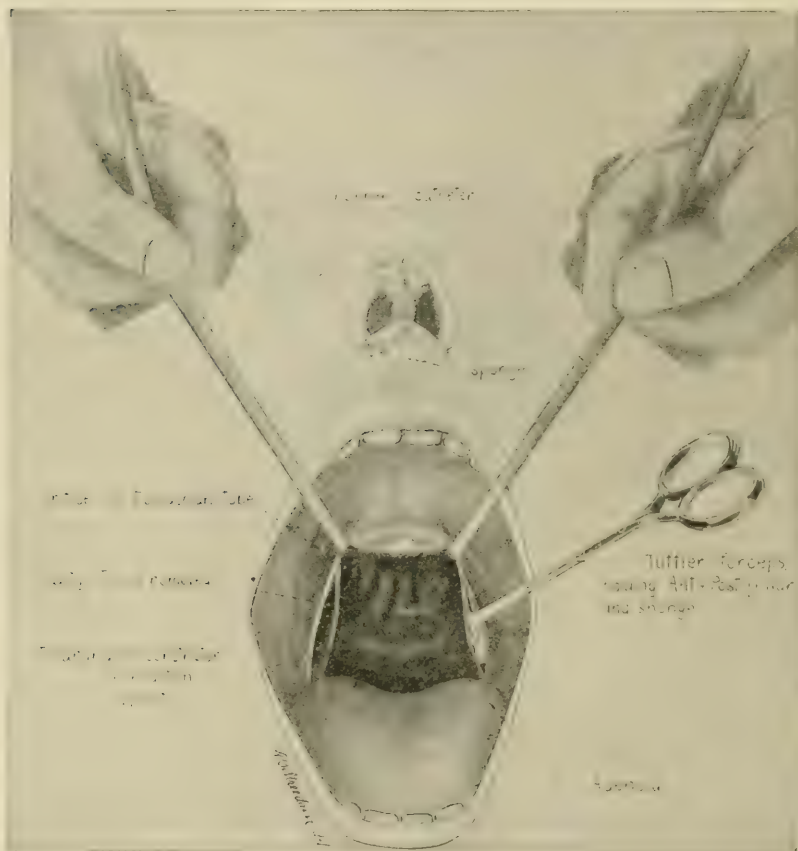


FIG. 15.—Diagram showing Beck's method of retracting the soft palate to facilitate the removal of the pharyngeal tonsil.

wrist turn. The side to side cutting scarcely disturbs the mass which is left practically *in situ*. The operation is done almost entirely under direct sight, especially when the lower edge of the mass is approached, so that stripping of the pharyngeal mucosa is practically impossible. When the adenoid tissue of the nasopharynx involves the region of Rossenmuller's fossæ Beck employs any straight ring curette or spoon. As soon as the adenoid is thoroughly removed, a gauze pad is mounted

on an artery forcep and passed into the nasopharynx to control further bleeding by pressure. Sometimes there is considerable persistent oozing in the median line and then an artery forcep is applied and the bleeding will be permanently controlled.

**Tumors.** A rather unusual type of *tumor* occurring on the *soft palate* is reported by Thomas Guthrie.<sup>1</sup> The growth was attached to the soft palate near the uvula and, on examination, was found to consist of a mixed salivary gland of the submaxillary type. The surface of the tumor was covered with squamous epithelium through which opened the mouths of several small ducts lined by columnar epithelium. Guthrie has made a search through medical literature and has not been able to find a record of a similar case.

For the treatment of inoperable *malignant tumors of the nose and throat*, Harmer<sup>2</sup> suggests the use of diathermy. It is to be considered only in the light of a palliating measure but offers certain distinct advantages over other non-radical procedures. The process consists of passing through the growth a high frequency current of great power. Two electrodes, the larger which is wrapped in wet towels is placed on the patient's chest, and the other, a small one, is applied to the growth. When the current is turned on, an intense heat is produced which rapidly destroys the tissues. The growth is practically burned away, and, if the mass is large, the first part attacked is removed with curettes and the deeper structures burned. Diathermy is a more simple procedure than an operation with a knife, and the searing prevents the loss of blood and also guards against sepsis. It is especially applicable to patients who are old or debilitated, as there is very little shock accompanying the operation.

## LARYNX.

**The Bronchoscope.** There is no doubt that the use of the bronchoscope is growing, and is being extended beyond the use for which it was originally intended, namely, the removal of foreign bodies, and is being employed more and more as a diagnostic and therapeutic measure. Skillern<sup>3</sup> considers tracheo-bronchoscopy a justifiable procedure in any throat condition which cannot be cleared up satisfactorily by the ordinary methods. It is exceedingly useful for diagnosis of an obscure cough and dyspnea and for treatment of tracheitis, dysphagia, bronchitis, and especially asthma. In his dispensary work he employs the laryngoscope and tracheoscope as a routine measure.

While in the large majority of persons the use of the laryngoscope is attended with a great deal of discomfort, we will find certain individuals

<sup>1</sup> Journal of Laryngology, Rhinology, and Otology, February, 1914, vol. xxix, p. 68.

<sup>2</sup> Ibid., October, 1914, p. 481.

<sup>3</sup> Pennsylvania Medical Journal, July, 1914, vol. xvii, p. 783.

in whom the examination by the direct method is more easy than by the indirect method. The instrument is also of importance in examining the laryngeal conditions of children and for this reason every laryngologist should be acquainted at least with the technique necessary for direct examination of the larynx.

Iglauer<sup>1</sup> suggests the use of an electro-magnet for the extraction of metallic bodies from the trachea and bronchi. Under certain circumstances the removal of foreign bodies from the bronchi is exceedingly difficult, because of the swelling of the tissues and the large amount of secretion consequent upon tissue disintegration. Two cases are reported by Iglauer. In the first case the secretion was so profuse that bronchoscopy was practically impossible, and no view could be obtained at all of the foreign body. He utilized the principles of magnetism by taking a solid steel bar and passing it down the trachea and into the left bronchi. A powerful magnet was attached to the bar and a large screw was very easily removed from the bronchus. In the other case the attempt failed because the foreign body was afterward found not magnetic. He carried out a series of experiments on animals and found that in a large number of cases metallic foreign bodies could be removed from the air passages by magnetism. The foreign body, however, must be free or only loosely impacted in the bronchus or trachea, otherwise the magnetism is apparently not sufficiently strong to disengage it from its position.

**Suspension Laryngoscopy** is an ideal method of dealing intrinsically with laryngeal growths. Robert Clyde Lynch<sup>2</sup> is enthusiastic in support of the advantages which it permits the operating surgeon. He says that only local anesthesia is necessary for the more simple benign growths, such as fibroma, papilloma and vocal nodules, but he prefers general anesthesia administered as warm ether vapor for the removal of malignant growths or papilloma when occurring in children. The advantages of the suspension laryngoscope are, that it enables the operator to use both hands, to pick up the growth with one hand and dissect it out with the other, and to take sufficient time and care to be sure that the growth has been entirely removed. In one case he actually stitched up a rather large mucous membrane wound with plain catgut. Also in cases of malignant tumors, the growth can be thoroughly dissected out and removed in one mass.

**Laryngeal Tuberculosis.** Casselberry<sup>3</sup> considers that hyperplasia of a mammillated or other typical type commencing at or near the subglottic portion of the base of the vocal process and marked by a furrow in the vocal angle, is not only one of the earliest but also the most distinctive of all the initial changes wrought by tuberculosis in the larynx.

<sup>1</sup> Laryngoscope, January, 1914, vol. xxiv, No. 1, p. 12.

<sup>2</sup> Ibid., July, 1914, vol. xxiv, p. 645.

<sup>3</sup> Journal of American Medical Association, November 15, 1914, vol. lxi, p. 1789.

He describes the vocal angle as a line of junction of several parts, the terminals of which converge at an angle. The angle starts at the base of the vocal process as represented by a small three cornered area beneath the terminal ridge of the cord, and mounting with a postero-lateral trend, it marks the line at which the superficial structures of the true cord, of the false cord, and the interarytenoid folds merge into one. The furrow in the vocal angle is due to the infiltration lessening the mobility of the mucous membrane covering the vocal cord at this angle. Tuberculosis occurring in this area may remain latent for years to finally disappear or to flare up at some unexpected time. He does not mean to say that the initial lesion in the larynx always occurs at this point but that a mammillated infiltration in this region is very characteristic of tuberculosis.

The *treatment of laryngeal tuberculosis* is naturally divided, and consists both of systemic measures designed to build up the general resistance of the individual and of local measures which have for their purpose the destruction of the lesion or the increase of the local resistance. It is probable that a large number of specialists tend to neglect the general treatment of such patients and in this connection it is well to bear in mind that a great many cases of laryngeal tuberculosis heal up without any local treatment whatsoever, some of them never having had the interior of their larynx even examined. St. Clair-Thompson,<sup>1</sup> speaking from a three years' experience dealing with laryngeal tuberculosis in a sanatorium, says that the sanatorium will yield very good results in the treatment of this disease, so that 20 per cent. or better may be expected to have the lesions of the larynx healed. Further, that limited or slight laryngeal lesions may become spontaneously arrested under proper sanatorium care. As a local measure for combating the disease, the galvanocautery is the best weapon that we have at present. In his experience he found it indicated in only about 20 per cent. of 178 cases, but it completed the cure in more than 41 per cent. of the cases in which it was employed. Thompson says that these satisfactory results have not, so far as he knew, been secured by any method outside of sanatoriums.

It is true that the general care of the patient is extremely important in the treatment of laryngeal tuberculosis but I believe such care can be had outside of a sanatorium if the patient will carry out strictly the necessary program. The advantage of the sanatorium is that it makes the patient live according to certain definite rules, and drills into them the necessity of observing the details of a carefully planned routine life. The local treatment of laryngeal tuberculosis is, however, extremely important, and, with the galvanocautery, local lesions, both infiltrative and ulcerative, can be completely eradicated when not too extensive.

<sup>1</sup> British Medical Journal, April 11, 1914.

Hinman<sup>1</sup> recommends the use of *scarlet red* in the treatment of laryngeal tuberculosis when there is ulceration. In his experience, the application of this drug gave prompt relief of pain and distinctly aided in the healing process. He used an ointment with the dye strength of 10 per cent., the base of which was sesame oil and vaseline. This ointment was applied, with applicators, twice daily to the interior of the larynx.

**Laryngeal Lupus** is a fairly uncommon affection, while **lupoma** is so rare as to make the two cases reported by Gechtmann<sup>2</sup> of considerable interest. He says that he had not been able to find any similar cases reported in either German or foreign literature and that they were the only ones seen in the very large number of cases of lupus which have been treated at the clinic of Prof. Gerber. In both cases there was also lupus of the nasal cavity and nasopharynx associated with the distinct tumor-formation in the larynx. In the first case the histological examination showed that the squamous epithelium had formed distinct papillæ which projected into the connective tissues. Around these papillæ there was a diffuse round-cell infiltration involving the sub-epithelial tissues, and scattered through this area there were a few isolated tubercles showing numerous giant cells. In the second case the lupoma was about the size of a plum stone, pedunculated, freely movable, so that it was removed from the inside of the larynx by a cold wire snare. This tumor showed a thickened cornified squamous epithelium which in places had developed into marked papillomatous folds. There was very little round-cell infiltration, and at first a diagnosis of fibroma was made, but, on further examination, a small circumscribed round-cell infiltration was found containing epithelioid cells and a somewhat necrotic centre.

**Cancer of the Larynx** has, for a number of years, been recognized as one of the most favorable of the malignant tumors for operative treatment. As long as it remains limited strictly to the interior of the larynx, the chances of a radical cure are very good. However, total laryngectomy is a formidable operation and is attended with a high mortality risk, so that improvement in operative technique, especially attempts to remove the growth without sacrificing the whole of this important organ is certainly one of the great surgical achievements. Of course, an early diagnosis is essential for success in the less mutilating operations.

Schmiegelow<sup>3</sup> begins his article on this subject by saying that surgical treatment of intralaryngeal cancer gives exceedingly good results, especially when compared with those obtainable by surgical treatment of cancer in other internal organs. He gives a summary of results

<sup>1</sup> Albany Medical Annals, February, 1914, vol. xxv, p. 78.

<sup>2</sup> Zeitschrift f. Laryngologie, Rhinologie and Grenzgebiete, 1914, Band vii, Heft 2, p. 205.

<sup>3</sup> Lancet, August 1, 1914, p. 300.

obtained by four different operators, namely, Semon, Chiari, St. Clair-Thompson and himself. The number of cases reported is 96. Those who remained cured for over three years were 44; those who have remained cured from one to three years were 17; under one year, 1. Recurrence has taken place in 25, and there were 9 deaths from the operation. The operation of choice in these cases is a laryngofissure which should be done as soon as a diagnosis has been confirmed by a microscopic examination of a portion removed through the mouth. The statistics given above concerns only the laryngofissure, not total laryngectomy or hemilaryngectomy. As to the technique of operation, after having opened the larynx, he cocaineizes with a 10 per cent. solution to which has been added a little adrenalin. After the neoplasm has been removed and all the bleeding stopped, the thyrotomy wound is at once closed without packing, and the patients are able to swallow on the day of the operation and can leave their beds a few days later.

Equally enthusiastic for the operation of laryngofissure in intrinsic cancer of the larynx is St. Clair-Thompson<sup>1</sup> who says that the treatment of intrinsic cancer of the larynx by laryngofissure is remarkably satisfactory. Since 1912, when he made a report before the Medical Society of London, he has continued to obtain the same good results; that is, no patient has been lost by operation and 80 per cent. have remained free from recurrence. This freedom from recurrence dates back in some cases to ten years. In this article, Thompson makes a plea for the use of indirect laryngoscopy and says that the indirect method allows the forceps to be slanted to the opposite side of the body, so that any growth on the cord can be more cleanly and completely seized than is possible with the limited action of cutting forceps working in a circumscribed circular tube.

Even when total laryngotomy is indicated on account of the widespread character of the carcinoma, cancer of the larynx is not a hopeless condition. Mintz<sup>2</sup> removed the entire larynx on account of malignant disease in 29 cases. Twenty-four per cent. of these cases lived for more than a year, and three are still in good health to date; the time elapsed being over seven, eight, and twelve years since the operation.

In contradistinction to the good results that follow from operative procedures on the larynx, the use of *radium* or the *x-ray* in carcinoma of the larynx, according to published reports, is not by any means satisfactory. Beck<sup>3</sup> reports 4 cases of carcinoma of the larynx with detailed accounts of the treatment with radium, and further gives a careful resumé of the experiments of others. As to the 4 cases, in 2 the growth disappeared at least for a time but, in the other 2, there was no response, in fact the cancer kept on growing. The results obtained are not nearly

<sup>1</sup> Journal of American Medical Association, September 19, 1914, vol. lxiii, p. 989.

<sup>2</sup> Russky Vrach, April 12, 1914, vol. xiii, No. 15.

<sup>3</sup> Annals of Otology, Rhinology, and Laryngology, March, 1914, vol. xxii p. 166.

so satisfactory as those which he has gotten in some of the cases of superficial carcinoma of the nose, throat and palate, and he inclined to the belief that larger doses of the radium element should be employed in the treatment of carcinoma of the larynx. When the radium treatment is kept up for a long period of time, symptoms somewhat similar to cachexia develop, but the condition is really not quite the same.

Torek<sup>1</sup> advises a gastrostomy whenever a complete laryngectomy has been done. He says that in this way the feeding difficulties are done away with until after the wound is healed, and he does not believe that the addition of gastrostomy to extirpation of the larynx adds very materially to the severity of the operation.

<sup>1</sup> Surgery, Gynecology, and Obstetrics, April, 1914, vol. xviii, No. 4, p. 515.

## OTOLOGY.

By TRUMAN LAURANCE SAUNDERS, M.D.

A review of the otological literature of the past year demonstrates nothing strikingly new. What work has been done has followed the lines already laid down. The European war, naturally, has caused an upheaval of the scientific as well as the economic world, and its results are shown by the paucity of the contributions of our confrères on the continent. Thus it will be seen that the following pages are derived chiefly from the American and the English contributions to our otological literature.

As far as aural surgery is concerned, I believe that an era of conservatism has replaced the wave of radicalism, which swept over the country some years ago, and for which otologists were somewhat justly reproached by their general brethren. The campaign for aural prophylaxis, and for the dissemination of special training in matters otological, is making itself felt. The large number of severe aural complications due to neglected ear disease, are being reduced to a minimum. General physicians as a class now realize the necessity of early and efficient treatment in acute diseases of the ear. This, together with the wholesale removal of diseased tonsils and enlarged adenoids, has also tended to cut down the cases of acute mastoiditis. Notwithstanding their altruistic attempts at self-destruction, however, otologists as a class will exist for some time to come. In the meanwhile the boundaries of the specialty are changing. No longer is the specialty of the ear linked with that of its distant cousin, the eye, but it has become more closely interrelated, with its logical and topographical neighbor, the specialty of the nose and throat. The influences effecting this transition are many and varied. First and most important is the failure by otologists to markedly alleviate the chronic catarrhal conditions of the ear by local treatment of that organ alone; and secondly their recognition of the fact that the most effective work in these cases must be done in their incipency, and in the nose and throat. A secondary factor also is the immense advance in intranasal and tonsillar surgery in the past ten years. I refer chiefly to the submucous operation, the operation for exenteration of the ethmoid cells and the operations for tonsillar enucleation.

Had we, as otologists, been able to cure deafness by the application of medicaments and application of mechanical treatment to the ear itself, I very much doubt if this change would have occurred.

The major surgery of the ear requires for its successful performance years of clinical and technical training, and while perhaps cases requiring major aural operations are relatively infrequent (when they do occur), they demand excellent judgment and a highly developed special technique.

On account of their prophylactic character, operations upon the nose and throat are far more frequent. The developmental period of aural surgery is largely past, and the rising surgeon of today is able to acquire, with comparative ease, that knowledge which the pioneers of this specialty laboriously gathered.

Under the title "Report on the Recent Developments in Otology," Thomas J. Harris<sup>1</sup> of New York has reviewed the literature on otology for the past two years. Some of these articles have already been abstracted in PROGRESSIVE MEDICINE, but, with these exceptions, the Editor has taken the liberty of quoting most fully from this excellent and comprehensive article. As a therapeutic innovation he mentions the use of *heated bog soil* in "the treatment of chronic affections of the ear" by a Russian named Maljutin.<sup>2</sup> His indications are: (1) "Different forms of exudative otitis, where ordinary treatment does not remove the exudate in the middle ear. (2) Adhesive catarrh. (3) Different diseases of rheumatic or gouty nature, involving the bony articulations in the ear. (4) Otosclerosis in its incipient stage. (5) Syphilitic affections of the sound receptive apparatus."

Thus it is seen that the whole field of the chronic non-suppurative conditions of the ear has been pretty thoroughly canvassed by this enterprising gentleman. When bog soil is not obtainable, he substitutes dry heat. The idea is refreshingly new. However, I am afraid that I do not share Maljutin's therapeutic enthusiasm, though I agree with Harris that "the method is so simple that it is deserving of a careful trial." I do believe that, in cases where there is a persistent catarrhal exudate, the question of the application of heat has not been sufficiently considered.

**Reëducation of the Deaf.** Upon this subject, Harris is optimistic. He says: "Nothing in recent years offers so much encouragement for relief as the methods for the reëducation of the hearing brought forward by Maurice, and others, in Paris. Maurice does not pretend to cure the cause of the trouble." He insists that both deafness and its cure are relative terms. "He does not claim to restore hearing where total deafness exists. Reëducation is not the only treatment employed by him." He adds rather vaguely: "The principle involved is the same as the cultivation of the sense of touch in the blind or of the eyes in those who use the microscope." Maurice evidently does not favor the voice as a means, it being "of limited range and inflexible." He uses

<sup>1</sup> New York State Journal of Medicine, vol. xiv, No. 2, p. 523.

<sup>2</sup> Archiv. f. Ohrenheilkunde, vol. xc, p. 245.

an electrical apparatus producing 100 to 4000 vibrations per second, and claims for it the following action: It mobilizes in a physiological manner the organ of hearing; it stimulates the auditory receptivity of the deaf; it excites the labyrinth in which the nerve fibers have become sclerosed and atrophied; the sonorous massage produces a vasodilatation; and the vibration stimulates the ciliated cells in the organ of Corti.

Dr. E. B. Dench, in the discussion of this paper, said that he investigated this subject rather thoroughly during the past year, and while he believed in the possibility of the education or reëducation of the deaf ear, he had not found the electrical apparatus to be of the least benefit. He, on the contrary, believed in the human voice, and mentioned the marvelous results obtained in young children by the oral method, as exemplified in the Wright Oral School. He mentioned the possibility of doing harm with an electrical apparatus, and said: "I believe, however, that a too violent or too prolonged stimulation of the ear by *any* sound will, in the end, do damage." To this I heartily agree. He concluded: "If mechanical devices are to be used, caution must be employed."

Harris then alludes to Otosclerosis, and considers chiefly a valuable paper by Citelli.<sup>1</sup> This author believes "the disease to be a vascular osteoporosis of the labyrinthine capsule, and that not one, but a number of conditions produce it, including "syphilis, osteomalacia, rickets, tuberculosis, different dyscrasias of uric acid origin, and diseases of the intracranial glands, especially of the hypophysis system."

He divides the disease, as regards the pathological conditions present, into: First, cases in which there is only an ankylosis of the stapes, and which show the characteristic Bezold triad; second, cases with bony fixation of the stapes and other foci of the spongifying process in the labyrinth, associated with an atrophy of the labyrinthine membrane, the so-called mixed cases; and third, an intermediary group, where there are multiple disseminated foci without any ankylosis of the stapes, showing particularly, involvement of the cochlea. Based on these grounds, he would abandon the term of otosclerosis as a distinct disease, and substitute for it the term "Otosclerotic syndrome" or preferably "otospongifying syndrome." It is needless to say that the treatment of this disease is still unsatisfactory. Citelli claims benefit to the tinnitus in the use of the extract of hypophysis.

Harris than takes up the question of the streptococcus mucosus infections. He justly gives credit for the recognition of the grave character of these infections to the New York Eye and Ear Infirmary, and then abstracts a paper by Zemann<sup>2</sup> who bases his article on observations of 21 cases. He believes operative cases of this organism are relatively

<sup>1</sup> Archives Internationales de Laryngologie, d'Otologie et de Rhinologie, November, December, 1913.

<sup>2</sup> Archiv f. Ohrenheilkunde, vol. xcii.

frequent. "In 50 per cent. of the cases the course is typical, *i. e.*, a long prodromal stage with slight symptoms and characteristic drum appearance, with a late development of the suppuration or a complete absence of the same. In most cases, there is no fever and sudden development of complications. In other cases, the mucosus suppuration presents the clinical picture of an influenza (pneumococcus) otitis with no particular difference from an ordinary otitis. He agrees with all other observers that these infections are apt to lead to mastoid and endocranial operations. He says: "Every elevation of temperature after operation, excluding other causes, points to an area of suppuration elsewhere and demands further operation." The question of this infection will be discussed later under another paper, therefore I pass over this radical statement without comment. It is interesting to note that Zemann considers this infection as a contra-indication to primary suture.

Of especial interest to us is Harris' abstract of a paper by Leidle,<sup>1</sup> first assistant to Dr. Alexander at the Vienna Polyclinic. It will be seen that he is not in full accord with the radical teachings of the Urbantschitch Clinic, the so-called "Vienna School." This conservative paper is especially welcome to those of us who have been disposed to question some of their more radical teachings.

**Indications for Operation in Labyrinthine Disease.** 1. Every diseased labyrinth dependent upon a purulent otitis, whether acute or chronic, combined with a labyrinthogenous intracranial complication, must be operated upon *at once*. Of these complications, the slightest degree is represented by a persistent headache, on the side of the affected ear.

2. Every labyrinth which shows involvement as the result of an acute or chronic otitis, with symptoms of acute diffuse labyrinthine suppuration, advanced nystagmus to the third degree toward the healthy side, and lack of response to the turning test, must at once be operated on in case the temperature is more than 38° C. or the symptoms do not abate within four days.

3. A labyrinth which, as the result of an acute or chronic otitis, is completely destroyed functionally and does not comply with the indications first given, must at once be operated upon, in connection with the radical opening of the antrum (mastoid), in case a spot in the bony capsule shows a pathological opening into the peri- or endo-lymphatic space (fistula, cholesteatoma, sequestra, tumor, etc.) or where there are persistent symptoms of irritation of the labyrinth, such as dizziness, nystagmus, and vomiting.

These indications for operation are based entirely on clinical experience, and have no relation to pathological and anatomical questions, especially that of the differential diagnosis between acute purulent and

<sup>1</sup> Archiv f. Ohrenheilkunde, vol. xciii.

acute serous disease of the labyrinth. This latter question is met in the second indication. Leidle states that general diffuse labyrinthitis must at once be operated upon if the temperature rises above  $38^{\circ}$  or if the symptoms persist in the same degree more than four days. It is his experience that a serous labyrinthitis never shows a higher temperature than  $38^{\circ}$  C., nor symptoms which do not begin to abate in intensity within four days.

He reports 27 cases operated upon: "In most cases the typical labyrinthine operation was performed," *i. e.*, after a medical operation the dura in the middle and posterior fossæ was freely exposed and the labyrinth drained.

"Fifteen of these cases were complicated by intracranial disease. These represent 4 labyrinthogenous, circumscribed purulent meningitis cases; 7 cases of labyrinthogenous, diffuse purulent meningitis; 1 case of serous meningitis; and 1 case of cerebral abscess. Of the 27 cases, 19 were cured, 8 died, a percentage of 29.6 of deaths and of 70.4 of cures. Two cases were operated upon when the meningitis had already developed.

"It will be noted that the first indication for operation is virtually to operate upon the slightest appearance of meningitis, but not before. The second indication is also to be regarded as a conservative one. It is, in effect, that serous labyrinthitis is never to be operated upon. His last indication is also equally conservative, when he advises, in connection with the radical operation, the opening of the dead labyrinth only in case a pathological opening exists or is found, or there are symptoms of irritation still persisting."

Harris then touches upon the question of meningitis, and characterizes the work of Kopetsky and Haines as highly commendable, but as representing no therapeutic advance. With equal regret he mentions the work of Day, of Pittsburgh, who has operated upon five cases by the Haines method.<sup>1</sup> He then abstracts the paper of Preysing read before the German Otological Society, 1912.

Preysing recommends the following classification of Alexander:

- (a) Meningitis with uncomplicated acute purulent otitis.
- (b) Meningitis with complicated chronic purulent otitis.
- (c) Meningitis with otitic brain abscess.
- (d) Meningitis with otitic thrombosis and extra-dural abscess.
- (e) Meningitis with purulent labyrinthitis.

His indications for treatment are:

"1. In meningitis following acute otitis, lumbar puncture, or, according to the circumstances, lumbar drainage. No opening of dura.

"2. Meningitis following chronic otitis without labyrinthine complications or with labyrinthine irritation symptoms, perform the radical operation and most carefully remove the channel of infection. If

everywhere a healthy brain is found, treatment is to be as for meningitis following acute cases, which are treated by lumbar drainage.

"3. In chronic cases where an extradural abscess is found and the symptoms do not disappear after emptying it, if the dura in the vicinity appears necrotic or in a wider course does not granulate, it is warrantable to incise the dura and seek for subdural necrosis.

"4. In chronic otitis existing with clear labyrinthine symptoms, the radical operation is to be made, and, where there is a fistula, resection of the inner ear is to be carried out. If dural changes are then discovered, according to Wittmaack and Stacke, the dura and the posterior fossa in the direction of the internal auditory canal (meatus) are to be opened as far back as the sinus and drained. Whether an entirely otherwise healthy dura is to be opened, or further operation will be left to depend upon the result of the operation upon the temporal bone, must be decided by the operator.

"5. If one finds, in the radical operation for chronic otitis with meningeal symptoms, a distinct dural fistula with drainage of pus, a thorough broad opening in the temporal bone is to be advised, and the diseased dura resected and drained."

Dench, in the discussion following, emphasized the fact that in his paper read before the International Otological Congress in Budapest in 1909, he drew attention to the value of lumbar puncture as a therapeutic measure, also the necessity of cleaning out the primary focus of infection and free drainage of the subdural space.

I think that I can testify as to the genuine disappointment of the otological world that the brilliant work of Kopetsky and Haines has not, up to this time, fulfilled its early promise. The crux of the meningitis question is still that of early diagnosis, and while the cases of localized meningitis may testify to the efficacy in surgical attacks, the cases of generalized meningitis still loom up as a bugbear which is yet to be dispelled.

The question of differentiation between a generalized and a localized meningitis is still a vague one, and until this is settled, we must continue to attack all meningitis cases with a fortitude and persistence worthy of future enlightenment.

Harris finally discusses the new symptom-complex recently brought forward by Barany,<sup>1</sup> and I feel that I cannot do better than to quote his abstract in full:

Barany has seen in the last few years more than 40 cases with symptoms of first, dizziness; second, tinnitus; third, difficulty in hearing, suggestive of disease of the inner ear; fourth, pains on the diseased side, beginning directly back of the ear and radiating to the occiput and also forward; fifth, tenderness directly behind the mastoid over the exit of the emissary vein; sixth, pointing deviation outward of the hand

<sup>1</sup> Wein. klin. Woch., 1913, No. 4.

on the diseased side. Barany regards these symptoms characteristic of increased pressure in the cysterna pontus lateralis, which is the cysterna of the cerebello-pontine angle.

The heightened pressure is due in the first place to adhesions of the arachnoid with the pia on the edges of the cysterna; second, to the lateral choroid plexus which has its origin inside the cysterna, secreting in a fluid in a normal or increased manner. Inside the cysterna lie the facialis, cochlealis and the vestibularis nerves. While the facialis probably does not suffer because of its stronger resisting power, the cochlealis and vestibularis become diseased. The interference with the drainage of the fluid, even whether the secretion is normal or increased, must lead to increased pressure. Inside the cysterna is found the centre of the cerebellar cortex for the movement of the wrist inward. Pressure would paralyze this and there would be a deviation of the joint outward. The causes of this heightened pressure are to be found, according to Barany, first in middle ear suppuration; second, in migraine; third, in syphilis; fourth, in rheumatism. In certain cases he has been able to relieve the condition by the use of atropin internally, which reduces the amount of the secretion. The result, however, has not been lasting. In place of a reduction of the secretion, he has, therefore, sought to increase it to such an extent that the adhesion would be broken. This took place in one case where the patient was in the habit of using alcohol. He recommends particularly lumbar puncture which has given excellent results, although recurrences can take place. In three cases after the lumbar puncture, he freed the dura in the posterior fossa from the mastoid process. In one case it was necessary to incise the dura in order to get a cure. The pointing test referred to has been recently described by Kerrison in a paper having particular reference to cerebellar abscess, as follows:

*Method of Applying Test.* If we irrigate with cold water, let us say the right ear, there is developed a well-marked rotary nystagmus to the left, and the individual, attempting to stand, tends to fall to the right. Now, quickly, *i. e.*, while the nystagmus is still active, test his pointing accuracy in the vertical plane by the method already described. It will be found that, having located the examiner's finger with his own by touch, his hand in being lowered will swerve somewhat from the vertical plane to the right, and again in being elevated it will deviate further to the right. His hand, therefore, in being depressed and elevated, describes a V falling to the right of the object he is trying to reach. Stating this reaction in the form of a rule, we may say that the pointing deviation resulting from vestibular irritation is invariably in the direction opposite to that of the induced nystagmus. It, therefore, corresponds with the direction of the falling tendency, *i. e.*, the direction in which, if he attempted to stand, he would demonstrate a tendency to fall.

The loss of pointing accuracy characteristic of a cerebellar lesion

may be demonstrated in the following way: The patient, being blind-folded, the pointing accuracy of the two hands is separately tested by the method already described. In a case in which the symptoms are present, it will be found that the arm corresponding to the cerebellar lesion will regularly deviate outward, while the opposite hand (*i. e.*, that corresponding to the sound side) will continue to point with normal accuracy. Thus in a lesion of the right cerebellar hemisphere, the right hand deviates outward, *i. e.*, to the right; with a left cerebellar lesion the left arm deviates to the left, the arm corresponding to the sound cerebellar hemisphere maintaining in either case the normal pointing accuracy. This is the first part of the test. We must now corroborate the result thus obtained by testing the reaction of vestibular irritation.

Supposing, for example, that in a case of suspected cerebellar lesion we have tested the pointing accuracy of both arms and found that the right arm shows unmistakable outward deviation (*i. e.*, to the right) while the left arm points accurately—this so far as it goes, would indicate disease of the right cerebellum. We must now test the reaction of the right arm to vestibular irritation. This is done by syringing the left ear (*i. e.*, the ear of opposite side to the supposed lesion) with cold water. This is followed by a rotary nystagmus to the right, during which in a normal individual both hands in pointing would deviate to the left. If now in the presence of an induced nystagmus to the right, the right arm does not deviate as normally to the left, but continues as before to deviate outward (*i. e.*, to the right), while the left hand shows the normal reaction to the left, we have a clear and positive indication of a lesion involving the right hemisphere of the cerebellum.

**Subjective Ear Noises.** Dr. Conrad Stein,<sup>1</sup> of Vienna, has contributed an article on "The Clinical Pathology and Therapeutics of Subjective Ear Noises," in which he draws attention to the relation of tinnitus to variations in the blood-pressure. While the article is somewhat trite and at times vague, it justly emphasizes the importance of recognizing the fact that tinnitus is not dependent upon conditions in the ear alone. He has made a careful study of 500 cases of tinnitus aurium, with special attention to the blood-pressure, and he gives the following table:

	Number of cases.	Normal blood-pressure.	Cases of blood-pressure higher than air.	Cases of blood-pressure diminished.	Cases of blood-pressure varying.
Tinnitus with normal ears	5	...	1	..	4
Tinnitus with true middle ear disease . . . .	117	82	13	6	16
Tinnitus with "otosclerosis" . . . . .	37	9	5	2	21
Tinnitus with middle ear and labyrinthine disease	111	73	18	11	9
Tinnitus with "inner ear disease" . . . . .	230	101	105	6	18

<sup>1</sup> Monatschrift f. Ohren., 1914, 5 Heft, p. 625, Trans. by Dr. A. Michaelis.

Thus it will be seen in these cases of tinnitus, 53 per cent. had normal blood-pressure, 28.4 per cent. raised blood-pressure, 13.6 per cent. varying blood-pressure, and 5 per cent. diminished blood-pressure. In cases with raised blood-pressure, he found arteriosclerosis with plain signs in 89 cases, and moderate signs in 23 cases. "Neurasthenia" with heart and vascular lesions in 17 cases. (He terms this state "presclerosis.")

In the 500 cases, 64.4 per cent. show vascular disturbances, 42.2 per cent. show organic heart and vascular lesions.

He then discusses the relationship between the changes in blood-pressure and tinnitus and says that he does not believe that tinnitus is due to changes in the blood-pressure alone, but to changes thus caused in the "auditory nerve region." He believes that tinnitus with normal hearing indicates beginning nerve trouble. He lays especial stress on the poisons of alcohol, nicotine, lead, and syphilis as agents in inducing vascular change, and thus indirectly affecting the auditory nerve. He thinks that the primary lesion is in the bloodvessels, eventually affecting the nutrition of the acoustic nerve. In discussing the causes of circulatory disturbances, he credits an important rôle to the urogenital apparatus and to the internal secretions. He believes that "acusticus disturbances" may manifest themselves in childhood. He maintains that all treatment should be directed not only toward securing normal circulatory conditions in the ear itself, but provision should also be made toward securing sufficient circulation in the "region of the auditory nerve." In this relation, he believes that mechanical treatment of the ear itself will give only transitory benefit unless a permanent change can also be effected in the general circulation. He then discusses the intranasal treatment in relation to tinnitus. He believes that irritation of branches of the trigeminus within the nose may cause increased blood-pressure, and on this ground explains the cases of tinnitus that have increased after intranasal treatment. He attributes this to a hyperirritability of the nasal mucosa, and rightly concludes that in these cases (if they can be diagnosticated) intranasal treatment should be very cautious.

In regard to general treatment, he emphasizes attention to the stomach and intestines and toward correction of the sexual neurasthenia. He believes in the usefulness of hydrotherapy, but thinks that its effect should be studied in each individual case.

He cautions against the indiscriminate use of the iodine preparations on account of their effect on the general nutrition.

Gorham Bacon,<sup>1</sup> in a paper read before the New York Academy of

<sup>1</sup> The Difficulties of Closing a Perforation in the Drum Membrane in Certain Cases of Acute Suppurative Otitis Media. Read before the Otological Section, New York Academy of Medicine, November, 1914.

Medicine, calls attention to certain **methods of closing perforations in the drum membrane in acute suppurative otitis media.**

The cases of persistent perforation usually occur in patients who have not seen the specialist until rupture of the drum membrane has occurred spontaneously.

He cites 3 cases. The first case came under his observation six weeks after the onset of the trouble, presenting a small perforation in the posterior and inferior quadrant of the drum head, with slight discharge. As the patient was going out of town, Bacon advised syringing the ear and the use of astringent drops. Under this treatment, the discharge became more profuse. So Bacon changed to the "so-called dry treatment," first touching the edges of the perforation with a silver nitrate solution gr. x to ʒj, and then insufflating boric acid powder. After a week's daily treatment of this character, the ear became dry and the perforation closed.

The second case he cured in a similar manner, occasionally, however, "applying a small disk of paper over the perforation."

In the third case the treatment extended over a period of six months. "The patient, aged thirty years, accidentally punctured her drum membrane with a hair pin. She consulted a physician who syringed out the auditory canal and gave her some ear drops, so that when Bacon saw her, she had an acute suppurative inflammation of the middle ear. "Under the use of astringent drops, the perforation seemed to grow larger, and the discharge did not decrease in amount. Insufflations of powder were substituted, and in a short time the ear became dry, but the perforation persisted. This was situated in the posterior inferior portion of the membrane, and involved about a quarter of the drum head. Silver nitrate solutions and paper disks were applied for a long while without avail. However, the hearing was improved with the disk in position. The perforation was finally closed by touching the edges with trichloroacetic acid."

Bacon used the method of Gomperz, as given in Politzer's book. It is as follows: "A piece of cotton soaked in a 10 per cent. solution of cocaine is inserted in the perforation and allowed to remain for ten minutes. A cotton-tipped probe is then dipped in a concentrated solution of the acid, and the excess is wiped off by means of a small piece of dry cotton." This is then applied to the edges of the perforation. "A white eschar forms, on the separation of which it is seen, even after one or two applications, that the perforation has grown smaller. The cauterization should be repeated at intervals of from four to eight days. The number of applications is usually from three to fifteen."

Bacon followed the above method with the exception that he insufflated boric acid after applying the acid.

Bacon is enthusiastic about this method, and has used it successfully in other cases. He thinks this method especially indicated in the old

dry perforations, "where, according to Politzer, the persistency of the perforation is due to the growth of the epidermis of the external layer of the drum, over the margins of the orifice into the tympanic cavity, thus preventing a cicatrix."

He also describes the use of the writing paper disks as advocated by Blake, but thinks their use is limited. He also mentions the use of the salicylic acid plaster disks advocated by Milligan, but adds that he has not tried this method.

E. Urbantschnitz<sup>1</sup> reports favorably on the use of a new antiseptic in cases of chronic purulent otitis media. This is a combination of methylene blue and silver, and contains 24 per cent. silver. It has not yet been put upon the market. It is used in solution 1 to 2 per cent., 1 to 2 drops instilled into a cleaned ear and allowed to remain for a minute. It is also used as a powder, 1 part to 100 parts boric acid.

Urbantschnitz believes it to be indicated in all cases suitable for non-operative treatment, which do not respond to the usual methods (O. M. P. C. with large perforations, tubal suppurations). It is also indicated in the after-treatment of the radical operations. The dry treatment seems especially indicated in cases with scanty discharge and large perforation.

**Oil of Mustard in Ear Pain.** Otto Schwartz<sup>2</sup> alleges that smelling the oil of mustard will relieve the pain in the ear due to acute inflammations and to external otitis. He exhibits great enthusiasm over this simple therapeutic method, but does not venture an explanation of its "modus operandi."

**Ear Infections due to the Colon Bacillus.** D. S. Dougherty<sup>3</sup> reports a series of 12 middle ear infections, evidently due to the colon bacillus. These cases occurred on his service at the City Hospital. In 4 of the cases the colon bacillus was isolated in pure culture, in the remaining cases it predominated, but was mixed with other organisms. He claims that he is the first to report a series of cases of aural infection by the bacillus coli communis.

He cites the "experiences of Hall, Alberan, Ackerman and others" as proving the virulence of colon bacilli in various organs in the body in the presence of other organisms, and also the fact that in 3 of his cases the organism was obtained in pure culture.

He thinks "there can be no question as to the active agent of the infection occasioned by the scratching of an abraded surface by a fecally contaminated finger." He also suggests infection through the Eustachian tube in severe vomiting.

**CASE I.**—Woman, aged twenty-six years. Bohemian. Three weeks before admission, pain in left auditory canal and mastoid. Two days after onset, discharge from canal lasting for three days. Cessation of

<sup>1</sup> Monat. f. Ohren., 1914, Heft 5, p. 711.

<sup>2</sup> Ibid., Heft 3, p. 334.

<sup>3</sup> New York Medical Journal, December 12, 1914.

discharge followed by swelling of face and scalp. On admission, temperature 101.2°, pulse 104. Left side of face and head edematous, eye partially closed. Eyes negative, no nystagmus nor neuroretinitis. A foul purulent discharge from left ear. Inspection of left ear showed canal reddened, swollen, evidently the seat of an old furunculosis; tympanic membranes intact, pinkish and retracted. Leukocyte count, 19,000. Polynuclears, 79 per cent. Operation showed large abscess, with foul, greenish-yellow pus extending over temporal, parietal, and occipital regions. A dehiscence of bone beginning at cortex and tegmen antri and extending upward and forward, exposing "sphenotemporal lobe." Exposed dura dark and covered with granulations, antrum and mastoid cells filled with foul pus and granulations. Spinal puncture gave sterile fluid. Culture of pus from abscess and mastoid showed colon bacillus in pure culture. The patient did poorly after operation, and finally died twelve days after operation. Upon autopsy, an abscess was found in the left temporal and occipital lobes, which gave colon bacillus in pure culture.

CASE II.—Female child, aged nine years. Large, subperiosteal abscess. Tympanic membrane normal. Collapsed posterior wall with perforation in its middle third. Upon operation, posterior wall found to be detached. Grooved channel eaten into bone from inside bony meatus to a saucer-shaped depression over antrum. From here a second groove in the cortex led to the mastoid tip, which was entirely necrosed. Antrum free from pus or inflammation, but lateral sinus partially exposed between tip and knee. Colon bacillus in pure culture. The child made an uneventful recovery.

CASE III.—Admitted to hospital for an ischio-rectal abscess. Operation. Recovery. Two months before admission deafness and purulent discharge from right ear. February 3, radical operation was performed, culture showed colon bacilli, few staphylococci and a positive bacillus. February 5, operation for sinus thrombosis, vein excised, found thrombosed one inch below bulb, no clot in sinus. Culture taken from wound at this operation showed "colon bacillus and streptococci moderately hemostatic." Blood culture negative. Patient died February 12. No autopsy.

The author also reports 9 other cases of less interest in which, with the exception of one, the colon bacilli were found predominating, but mixed with other organisms.

In the first 2 cases (also in Case XII), Dougherty thinks the point of entrance of the colon bacillus was through the canal wall.

If the author's inferences are correct, that the entrance of the colon bacillus causes any previously existing mild inflammation of the middle ear or auditory canal to flare up, it has an immense practical bearing upon the prophylaxis and care of our patients suffering from any supuration in this region.

**The Radical Operation.** Among the interesting papers appearing during the past year is one by Dr. Fred Whiting,<sup>1</sup> of New York, upon the Radical Operation. The views of this master of operative technique are worthy of the most careful study and consideration.

He defines chronic suppuration of the ear "as a constant or recurring intractable discharge which has persisted for more than one year, notwithstanding the intelligent employment of proper local treatment associated with measures directed to the correction of any diseased condition of the nose and throat."

He classifies chronic purulent ear disease according to the "natural anatomical subdivisions of the structure," arranging it in three comprehensive groups.

First, those diseased conditions which involve the tympanum and its contained structures only, with retention of good hearing.

Second, those diseased conditions which involve the tympanum and mastoid process. Hearing is sometimes good, but is usually much impaired.

Third, those diseased conditions which involve the tympanum, mastoid and labyrinth, in which the hearing may be slightly impaired, (circumscribed labyrinthitis-fistula), or entirely destroyed (chronic diffuse purulent labyrinthitis).

Regarding the cases of the first group, Whiting adopts a conservative attitude, and he disagrees with the otologists who declare that every case of purulent otitis not yielding to local treatment requires a radical operation. In cases of long continued discharge without pain, fever, nausea or any disturbance of equilibrium, *i. e.*, with good drainage and showing no cholesteatoma and no fistula into the hypotympanum, and especially when the ear retains useful hearing, he believes that the patient is safe without operation, if under the observation of a skilled otologist. If, because of his occupation, he is compelled to live for protracted periods in a community without one, he believes that it is safer to do a radical operation. He further states that in carefully selected cases of this first group, the Yankauer Operation (ossiculotomy with tubal curettage and closure) is indicated. He states that 75 per cent. of the simple cases can be cured in this manner.

The two conditions under group one which require the radical operation are attic suppuration and tuberculous ear disease in children. Dead bone in the attic may frequently be easily recognized by the introduction into the perforation of a slender applicator tightly and smoothly wound with a thin filament of cotton. Upon its withdrawal the cotton fibers will frequently be frayed, denoting contact with the "roughened surface of dead bone."

<sup>1</sup> Indications for the Radical Operation, and a Consideration of the Steps Essential to a Successful Healing. Read before a Meeting of the Clinical Congress of Surgeons, 1913.

Tuberculous ear disease in children, unless bilateral or accompanied by pulmonary tuberculosis, should be treated by a radical operation as a means of affording protection against tubercular meningitis. In this connection it would be interesting to know how many cases of tuberculous meningitis have had an antecedent ear history. I myself saw one such case last year, in which a child with a chronic discharging ear presented symptoms of tuberculous meningitis, and the question arose whether the meningitis was tuberculous or a simple meningitis and brain abscess due to an invasion of the meninges from the middle ear. In this case, however, an exploratory operation was refused by the parents and, later, tubercle bacilli were found in the spinal fluid. Autopsy was not obtained and the ear process was never definitely proven to be tubercular.

Whiting thinks that any case of chronic ear suppuration in a small child, associated with enlarged lymph nodes (eliminating scarlet fever and measles) is suspicious of a tubercular infection. He believes that the only absolute proof is animal inoculation, a positive Von Pirquet test showing only tuberculosis in some part of the body. However, he believes that a negative Von Pirquet rules out tuberculosis.

In a case of unilateral ear discharge, with fair hearing, in which the patient is profoundly deaf in the sound ear, he believes that operation should be postponed as long as useful hearing remains in the diseased ear, providing no dangerous complications ensue.

In the second group he places the cases of cholesteatoma. To quote from the author: "In my judgment, there can be no question of the wisdom of operating at the earliest possible moment upon any case of suppurative ear disease which is accompanied by demonstrable cholesteatoma, and should the growth prove to be of the encapsulated variety, the operation should provide for continuing the after-treatment through a permanent posterior opening."

I think at the present time all aural surgeons are united on the advisability of operating upon these cholesteatoma cases, but many will disagree with Dr. Whiting upon the advisability of a permanent posterior fistula in every case. Many cases of small cholesteatoma can be adequately treated through the auditory canal, provided a proper plastic flap has been made.

Aside from the cholesteatoma cases, Dr. Whiting has not stated definitely the operative indications of cases in group second, other than stating that in this group will be found the largest number of cases which will properly require the radical operation.

Third group. Those diseased conditions which involve the tympanum, mastoid and labyrinth, in which hearing may be slightly impaired (circumscribed labyrinthitis-fistula) or entirely destroyed (chronic diffuse purulent labyrinthitis).

Whiting relies chiefly on the functional tests for a diagnosis of laby-

rinthine involvement, as physical evidences of labyrinthine involvement are rare. However, he agrees with Neuman in regarding "facial paralysis occurring in cases of chronic suppuration of the ears as suspicious of labyrinthine involvement."

He says: "The existence of a circumscribed labyrinthitis is determined by our ability in the presence of at least a partial preservation of the labyrinthine function to elicit a positive fistula test." He adds: "Circumscribed labyrinthitis seldom occurs except as an accompaniment of chronic suppurative otitis media, and, if subjected to any operative procedures, the radical mastoid operation should be performed. In this case, if the patient is entirely deaf in the other ear (non-suppurative) he advises against operation in the affected ear, if it retains useful hearing, unless a diffuse purulent labyrinthitis supervenes."

He makes his diagnosis of chronic diffuse purulent labyrinthitis upon cases in which there is no hearing, and in which the caloric and fistula tests are negative. In these cases, if any operation is done, the combined labyrinth and radical operation must be performed. Whiting wisely attempts to lay down no hard-and-fast rule for operating upon these cases, but leads us to infer that each case must be decided upon its individual merits. He also reminds us of the well-known fact that there exist cases of chronic purulent otitis media, with entire loss of labyrinthine function, which are not necessarily examples of chronic diffuse purulent labyrinthitis; and calls attention to Ruttins' Compensation Symptom. In the presence of diabetes, tuberculosis, chronic Bright's disease, and arteriosclerosis with cardiac valvular disease, he states that "chronic suppuration of the ear should be submitted to operation only when the exigencies of the situation demand it for the preservation of life." In these cases nitrous oxide and oxygen are indicated as an anesthetic.

He also discusses the question of the radical operation in very young children, and advises deferring it "as long as the patient retains fairly good hearing, shows no symptoms of mastoid or labyrinthine involvement, and remains within the reach of prompt and skilful surgical attention."

He then passes to the discussion of several points in the operative technique, "neglect of thorough attention to any of which may be responsible for failure." They are: (1) complete removal of dead bone; (2) lowering of the facial ridge; (3) careful obliteration of both epitympanic and hypotympanic spaces with destruction of the eugomatic cells; (4) complete closure of the Eustachian tube; (5) thorough destruction of the tympanic mucoperiosteum; (6) the construction of an adequate meatal flap and the application of a Thiersch graft to the bone cavity.

1. *Removal of Dead Bone.* Whiting emphasizes strongly the necessity for the *minute* inspection of the operative cavity for the detection.

and removal of particles of necrotic bone which might escape the average operator.

2. *Lowering of the Facial Ridge.* He says that the facial ridge should be lowered as far as is compatible with the safety of the facial nerve. It is to be regretted, however, that he does not give us his method of accomplishing this result.

3. *Obliteration of the Epi- and Hypotympanum.* The author insists upon the removal of *all cells* that may be found in the epitympanum (attic) together with any zygomatic cells that have survived the obliterating effects of the chronic productive inflammation. He does this by chiseling away the superior bony meatal wall through the tympanic ring.

Whiting then takes up the consideration of the hypotympanum. Obliteration of this cavity is accomplished by planing away the floor of the auditory canal until the "floor of the meatus is flush with the lower margin of the tympanus." To do this, Whiting uses an angular hand gauge of his own design. He then scrapes away the cells of the hypotympanum. He says: "The remarkable distance which these cells extend forward along the floor of the Eustachian tube, and upward and backward beneath the facial canal, is oftentimes truly surprising, and when observed serves to emphasize their significance as probable receptacles for the retention of infective products and as inaccessible recesses into which diseased mucoperiosteum will dip and escape the search of a careless curette."

4. *Complete Closure of the Eustachian Tube.* The author emphasizes the necessity for the obliteration of the lumen of the tube. He does this in the following steps:

(a) Removal of the anterior lip of the tube. A pyramidal-shaped hand burr is used, serrated on one side only. It is revolved through an arc of 90 degrees, the smooth surface of the burr bearing against the thin bone of the carotid canal.

(b) The mucous membrane of the tube is then removed with a Yankauer curette.

(c) The superior wall of the tube is then thoroughly curetted under, to break into the lumen of the bony canal for the tensor tympani. Whiting claims that this part of the technique is not sufficiently appreciated, and its neglect often results in a patent tube after an apparent thorough curettage.

(d) As a supplement to the above measures, Whiting finally applied a bichlorid solution 1:500 with a small tightly wound cotton-tipped applicator.

5. *Destruction of the Tympanic Mucoperiosteum.* Whiting believes in stripping the cavity entirely of its mucoperiosteum. In this he is at variance with a considerable number of otologists who insist that the mucous membrane over-lying the promontory should not be curetted.

6. *Construction of the Flap.* Whiting employs a flap similar to the Jansen flap.

The Employment of the Thiersch Graft. The author is a hearty advocate of a primary Thiersch graft. He believes that healing is hastened and that a better degree of hearing is preserved. He does not believe that in competent hands the primary graft is a source of danger. He attributes the apparent fatalities following this method to faulty technique rather than to the method itself. He believes it to be contra-indicated in labyrinth cases and in cases of encapsulated cholesteatoma. He has never seen any ill-effects following the application of a primary graft to healthy dura, but he has "seen fatal consequences follow the application of a secondary graft applied after an interval of five days over exposed dura from which some large granulations had been cured."

In conclusion, Whiting states that in the future our efforts should be directed not only toward obtaining a dry ear following a radical operation, but toward preserving a greater degree of hearing.

**Operation to Open the Cavernous Sinus through the Orbit.** In an interesting paper, read before the American Otological Society, Mosher<sup>1</sup> reports his attempt to open the cavernous sinus through the orbit. His first case was on the living, but was unsuccessful. A Krönlein was done, and the globe retracted inward. This did not give enough room, so the eye and contents of the orbit were removed. Then an opening was chiselled through the orbital plate of the great wing of the sphenoid, the brain retracted upward, and the cavernous sinus supposedly located and incised. Autopsy showed the sinus grazed, but not opened. Instead of entering the cranial cavity as he tried to do, through the orbital plate of the great wing of the sphenoid, he had gone too high and opened the roof of the orbit in front of the lesser wing of the sphenoid, and just above the cavernous sinus.

The following operation is the result upon his subsequent studies on ten cadavers. It has not yet been tried on the living.

*Operation.* The globe of the eye is removed and the orbit cleaned out. Then the ophthalmic artery is tied. The periosteum is cleaned from the posterior half of the floor of the orbit and the groove recognized in which the superior maxillary nerve runs. The next step is to separate the periosteum from the orbital surface of the great wing of the sphenoid and to recognize the outer end of the sphenoidal fissure. With the chisel placed vertically, a cut is made through the orbital plate of the great wing of the sphenoid from the notch for the superior maxillary nerve below to the outer end of the sphenoidal fissure above. The bone is thin along this line and is readily removed. It is important to make sure that the whole of the bone making the lower border of the fissure is taken away. The bone opening is enlarged outward one-half centimeter, using either rongeur or chisel. The lower edge of the bone

<sup>1</sup> Trans. Amer. Otological Soc., 1914.

window should be brought flush with the floor of the orbit. Unless this is done, it is not easy to get at the bottom of the middle fossa from which the dura is to be elevated. The enlarging of the bone window outward is best accomplished, at least on the cadaver, by a straight chisel. The orbital plate of the sphenoid thickens quickly at the outer inferior angle, and may measure at this point one-half centimeter. If the window is carried further outward, the zygomatic fossa is opened. The bone is so thick where the orbital plate makes the apex of the zygomatic fossa, that the approach to the middle fossa and the cavernous sinus by removing first, as I did on the living, the malar bone by the method of Krönlein and then attacking the orbital plate from without inward, starts the operation on thick bone, and makes the exposure of the dura slow, consequently the operator becomes timid.

Furthermore—there are no landmarks by which to make the bone incision, so the operator may easily, as I did, go too high, and enter the anterior instead of the middle fossa. By making the bone incision as has just been described, that is from the groove of the superior maxillary nerve upward to the outer end of the sphenoidal fissure, the orbital plate of the great wing of the sphenoid splinters off in much the same fashion as the bridge comes away in a radical mastoid operation with the last stroke of the chisel. Having quickly uncovered the dura, the operator goes on confidently. The bone window, made and enlarged outward and brought flush with the floor of the orbit, the dura is then elevated from the floor of the middle fossa, working from the outer boundary of the bone window inward. On the cadaver the dura can be separated from the outer wall of the cavernous sinus for a distance backward of about one centimeter, then the separation becomes hard. If the elevation is persisted in at the level of the bottom of the bone window, a pin head opening is torn in the outer wall of the sinus at this point. I do not know whether this is due to dividing a vein running in the outer wall of the sinus or whether a strand of one of the nerves in the outer wall of the sinus is torn away. Above and beyond this point of adhesion between the outer wall of the cavernous sinus and the dura the two can be separated for about a centimeter further. Then the emergence of the ophthalmic division of the fifth nerve from the Gasserian ganglion halts the separation. If the attempt is made to separate the inner wall of the cavernous sinus from the outer wall of the body of the sphenoidal bone, the knife may have to be used to start the separation, but once it is started, it can be carried back easily to the limit of the sinus. Experimentation makes me feel that the exposure of the outer wall of the sinus is the better. Choosing then the exposure of the outer wall of the sinus, and having separated the dura from it for a centimeter, a blunt pointed knife is placed against the sinus on a level with the floor of the orbit and the knife blade carried toward the body of the sphenoid

until it is stopped by the bone. This incision opens the outer wall of the cavernous sinus for one centimeter and is well below the internal carotid artery. Through this incision a small curette can be carried back to the opening of the superior and inferior petrosal sinuses, that is, through the whole body of the sinus. The distance from the rim of the orbit is on the average between 3 and  $3\frac{1}{4}$  inches ( $7\frac{1}{2}$  to  $8\frac{1}{2}$  cm.).

Given a cavernous sinus thrombosed or full of pus, what would happen in life, in my opinion, is that as soon as the separation of the dura from the outer wall of the sinus was begun, the sinus would rupture. The escaping pus would then guide the curette into the cavity of the sinus.

**Type of Operation in Sinus Thrombosis.** In an article read before the Clinical Congress of Surgeons of America at a meeting held at London, July 29, 1914, Hugh E. Jones, of Liverpool, discusses the type of an operation to be done in a case of sinus thrombosis.<sup>1</sup>

His deductions are based upon an experience of about 30 cases, and he also has given the answers to a set of questions sent to twenty-five British otologists and general surgeons practicing outside of London. While American otologists may not agree with all of the conclusions drawn by the author, the paper is of great interest as showing the British point of view in regard to certain phases of sinus thrombosis which are being perpetually discussed.

"Facts which influence the Extent of the Operation before operation has begun."

He states that we must take into consideration the fact that metastatic abscesses have occurred in simple streptococcal otitis media without sinus thrombosis, because they may present systemic symptoms of sinus thrombosis. He adds: "The rare cases of primary septic thrombosis of the petrosal sinus or a persistent petrosquamosal sinus may also give early pyemic symptoms without at once causing thrombosis of the lateral sinus or bulb." While I do not attempt to deny that the above conditions exist, they must be rare. I do not see how it is possible, in a case of middle ear suppuration presenting symptoms of pyemia or metastatic abscess, to exclude the jugular bulb or lateral sinus as a causal factor.

He then goes on to discuss the ordinary pathology of the formation of a thrombus in the lateral sinus or jugular bulb. He discusses the formation of the clot and draws attention to the fact that where the clot has once reached the horizontal (lateral) sinus, there is nothing to prevent its extending to the torcular Herophili. Jones has reported 3 such cases, 2 of which died, while one recovered after a long illness and without operation upon the opposite sinus. He believes this question

<sup>1</sup> Some Considerations Which Determine the Extent of an Operation in Septic Invasion of the Lateral Sinus, By Hugh E. Jones, M.R.C.S., L.R.C.P., Liverpool, England. Senior Honorary Surgeon, Liverpool Eye and Ear Infirmary. *Surgery, Gynecology and Obstetrics*, December, 1914.

of extension to the opposite sinus "has not received the attention it deserves in the literature." He thinks "that this extension is a possibility which is occasionally overlooked, and it is not unlikely that operations in the wrong direction (*i. e.*, toward the neck) are sometimes performed with the object of arresting systemic infection." When the sigmoid sinus is firmly clotted, extension downward is less likely than extension backward. He believes that "extension downward, if it takes place at all, does so *before* the sigmoid clot is fully formed, or after disintegration has set in, or when a half-formed or breaking-up clot is disturbed by operation or sudden movements of the head or neck. Such conditions, *i. e.*, the presence in the sinus or vein of septic fluid or semi-fluid contents, urgently demand immediate ligation and excision, or free opening of the vein."

He adds: "There are several stations at which the natural progress of infection may be arrested temporarily, *viz.*: at the sinus wall, at the superior petrosal sinus, at the entrance into the bulb, and finally at the junction of the facial vein. It is for the surgeon to determine what stage has been reached at the time of operation; whether it is possible to limit the extent of the operation, accordingly, will depend on the virulence of the process and the clot-forming and germ-resisting power of the individual's blood."

While these points in pathology have all been brought out at the time of operation, I believe it hardly possible to make a sufficiently exact clinical diagnosis of the extent and character of the clot to be guided thereby in our operative measures. I think that the majority of American otologists feel safer with the clot evacuated and the vein resected, than in those cases where it has seemed best to be content with an evacuation of the clot alone.

He then considers the extension into the petrosal and cavernous sinuses and states that they are of rare occurrence. Two of his correspondents stated that they believed ligation of the vein had caused immediate invasion of the cavernous sinus. To guard against this, he believes that the vein, if tied, should be also excised or opened at once (after occlusion of the proximal end of the sinus) when the contents are more or less fluid.

This brings up an interesting point in the causation of a cavernous sinus thrombosis; while these cases are rare, they are deserving of further study, both as regards etiology and as to operative treatment.

He then discusses the anatomical malformations of the sinus and their influence upon operation, but wisely adds: "When the need for ligation is a real one, the risk of ligation must be taken." He then discusses the "completion of the Diagnosis during the Course of the Operation." On account of the impossibility of an exact diagnosis as to the character and extent of the clot before operation, he thinks that it is necessary in all cases to *first expose* the sinus (after the mastoid operation has been

completed, the one exception to this rule being "when the disease has existed for several days, lung metastases are present and rigors are frequent." (Clot in the state of disintegration.) Then he thinks preliminary resection of the vein saves valuable time.

Jones cleans out the mastoid and opens the sinus groove with as little disturbance to the sinus as possible, "until at least half an inch of healthy wall is exposed, if possible, at both ends of the diseased area." He goes on to say "several of my correspondents say there are no reliable indications as to the condition of the intima, or of the character of the contents of the sinus, prior to an exploratory incision or aspiration." With this I cannot agree. My experience is that healthy granulations and pus, in the absence of a history of repeated rigors, vomiting and oscillating temperature, indicate a sound intima and fluid blood.

"The absence of granulations over any part of a sinus which has not the healthy bluish-white, semi-translucent normal appearance, indicates infection of the intima and either solid or mural thrombus. A thickened, discolored wall, with severe systemic symptoms at an early stage, means mural clot; at a late stage, after a comparatively quiescent period, disintegrating clot; mild systemic symptoms with partial collapse and a sloughy wall at one point, the localized breaking down of a solid thrombus. If the focus of disease is in the tympanum or anterior part of the antrum, with normal appearance and pulsation, but increased distention of the sigmoid sinus, and if there is pain, tenderness and stiffness of the neck, and the presence of systemic symptoms, the diagnosis is primary clotting of the bulb."

"These and other indications given by some of my correspondents" (he thinks) "obviate the necessity for palpation and exploratory aspiration of the sinus."

"Incision should, in my opinion, be made not so much as an exploratory procedure, but as a continuation of the operation and with the necessity of the obliteration of the sinus in one's mind."

"This being so, I expose the sinus until nearly an inch of healthy wall is uncovered on the torcular side, and compress it there with a plug of gauze between dura and bone." If, after following the sinus down toward the jugular foramen, no healthy wall is reached, or if there is any doubt about the condition of the bulb and vein, and the systemic symptoms have been severe, I expose the internal jugular vein at the junction with the common facial. Hitherto, having exposed the vein, I have invariably dealt finally with it by ligation or excision.

In the future, however, Jones proposes to expose the vein for inspection, and in a certain number of cases he may be able to save it.

I think it doubtful if the evidence thus gained will compensate for the operative risk and shock in exposing the vein. In my opinion, it is better to take it out or leave it alone altogether.

He says "if the sinus is clotted and the lower limit cannot be reached, expose the vein." Conversely, I presume, if the clot can be evacuated and there are no marked systemic symptoms, the vein is left intact.

If the vein has been exposed and found collapsed above the facial, but full and healthy below, Jones ties above the facial in two places and divides the vein, bringing the upper end into the wound. He then endeavors to force out the clot in the bulb by gentle irrigation. If collapsed below the facial, he ligates as far down the neck as possible, excises a considerable piece and brings the upper end into the upper angle of the wound for immediate drainage. To his mind, immediate drainage from the upper end of the vein is extremely important.

To my mind, the great objection to Mr. Jones' conservative treatment of the vein "provided it is healthy," is that one can not always determine a diseased vein by the gross appearance. Not infrequently has there been microscopically demonstrated a periphlebitis of an excised jugular vein that was apparently normal. In such a case of mine, the vein was apparently normal, yet microscopic section showed numerous streptococci in the outer walls.

On this account I believe it safer to resect as much of the vein as is possible (if consistent with the condition of the patient), and not rely too much on its gross appearance. Mr. Jones seems also fond of irrigation. This practice has never commended itself to me.

He has never tied both jugulars, explored both sinuses, resected the clavicle or ligated the innominate or subclavian veins. However, he thinks these operations "appear to be within the bounds of practical surgery."

I regret that Mr. Jones did not give us his views upon resecting the vein in infants and children. He does not discuss blood counts, lumbar puncture and bacteriological investigation (blood cultures) because he does not think that they have any "influence" on the extent of the operation. "At least," he adds, "of the first operation." After this he thinks "they may afford valuable information leading to further operation, or to the employment of vaccines." With this I think we will hardly agree.

It is interesting to note the answers to the following letter which was sent to twenty-five surgeons and otologists:

**"OTITIC SEPTIC SINUS THROMBOSIS."**

As the result of your own personal experience:

Q. I. Which would you do first—tie the internal jugular vein, or expose the sigmoid sinus?

(a) When one rigor has occurred and there is some pain and stiffness in the neck without other signs of vein involvement.

(b) When rigors have been repeated and other classical symptoms have been present for several days, but there are still no local signs of the jugular vein being affected.

(c) When there are local signs of vein thrombosis.

Answers:

A. I—(a) Twenty-two expose sinus only, without exploring it. Two explore sinus, then tie vein. One ties vein, then explores sinus.

(b) Two always explore and slit up sinus only. Four expose sinus, and then tie vein. Thirteen explore the sinus and then tie vein if necessary. One exposes the vein for information. Five tie the vein first and then explore the sinus.

(c) One explores sinus alone. One explores sinus and then opens the vein if clotted, without ligating it. Eight explore the sinus first; three of these tie the vein occasionally. Five tie the vein always. Fourteen tie the vein first.

Q. II. Supposing the sinus to have been exposed in condition I-a, perisinus abscess found, and sinus wall thickened and covered with granulations. Would you explore sinus at same operation, and if so, how? Would you tie the vein before exploring the sinus?

II. Answers. Two never explore sinus at first operation. Eighteen expose sinus and then act or wait, according to findings. Five, if intending to explore sinus, tie vein first, and four are doubtful.

III. Question. Do you think it is ever advisable or justifiable not to tie or excise the vein in conditions I-a, b and c? Have you any strong views based on actual experience for or against tying the vein at all in any of the above conditions?

III. Answers. (I-a) Nineteen consider it justifiable not to tie. One thinks it is never justifiable not to tie the vein. (I-b) Seven think it sometimes justifiable not to tie the vein. Five never justifiable. Two never tie the vein. (I-c) Twelve think it never justifiable not to tie the vein. Two never tie the vein.

IV. Question. What do you consider to be the best indications before opening the sinuses?

(a) Absence of clot.

(b) Absence of endosinusitis.

(c) Mural septic clot with permeable sinus.

(d) Primary clotting in the bulb of the jugular vein.

IV. Answers: (a, b and c). Eleven give no answer, or say there are no trustworthy signs. Nine employ palpation of the sinus with or without fluctuation from vein to sinus. Most rely on color, distention, pulsation, density of contour of wall, and the presence or absence of systemic symptoms. (d) Answers too varied to classify. W. S. Kerr: Delayed rigors with septic temperature chart, labyrinthine symptoms, tenderness between jaw and mastoid. T. S. Fraser: Great bleeding during mastoid operation from bone and emissary veins. Knowles Renshaw: Healthy sinus, no fluctuation in sinus when pressure is applied along vein. Hamilton A. Ballance: Pyemia with absence of disease about the sinus. W. S. Syme: Temperature chart, rigors,

absence of upward flow into sinus. G. Wilkinson: Indications got from exposure of vein in neck. E. M. Stockdale: Thrombosed sinus with healthy mastoid. Constable Harjes: Pain on swallowing referred to tonsillar area. Associated with mastoid symptoms. T. O. Graham: Early stiffness of neck and no marked local signs around sinus at operation.

V. Question. Do you employ any special method to determine the extent of the clotting, *e. g.*, palpation, fluctuation from vein to sinus, or tuning fork auscultation, and with what result?

V. Answer. No mention is made of tuning fork auscultation, nor of absence of "bruit de diable."

VI. Question. Technique of Operation.

1. How do you deal with the torcular end of the sinus?
2. How do you deal with the distal end when the vein has not been tied?
3. Where do you tie the internal jugular vein?
4. Do you excise a portion or the whole of the vein?
5. If you do not excise, how do you treat the divided vein?
6. Do you irrigate the sinus and vein?
7. If vein is excised, what drainage do you employ?
8. What is your experience of suppuration along the great vessels?
9. Do you consider it necessary under any conditions to expose the bulb?
10. Have you ever tied both internal jugular veins or explored or obliterated both lateral sinuses? If so, what result?
11. Have you ever found it necessary to resect the clavicle or tie the vertebral vein?

VI. Answers.

1. Six drain, then plug the lumen if bleeding. Two incise, fold walls in and pack. Eight use gauze pressure pads, and one uses rubber sponge. Twelve remove clot until blood comes. One leaves it alone.

2. Eight, plug lumen. One folds in walls and packs. Four use gauze pressure pads. Five remove clot until blood comes. One leaves it alone.

3. Nine tie the internal jugular vein above the facial vein, if there is no clot below. Eight, below the clot. Six, always below the facial vein. Two, at root of neck. Two, opposite the thyroid. Two, opposite the cricoid.

4. Thirteen excise none. Two, all. Two as much as possible, when clot is present. Five, the diseased part. One remainder after stitching upper end of wound.

5. Four, double ligature, divide vein and leave in wound. Sixteen, double ligature, divide, and fasten upper end in wound. One, inserts tube and gauze in vein and upper end. One uses Ballinger's stab-wound method. One "packs" it. Three open vein freely *in situ*.

6. One, sinus only. One, sinus and vein separately. Nine, through from sinus to vein. Ten, do not irrigate. Four, sometimes irrigate.

7. Three, gauze. One, split rubber tube. Three, gauze within rubber tube. One, iodoform worsted. Several did not reply.

8. Ten had never seen it. Four considered it dangerous. One thought it rare if vein was brought out of wound. One had only small localized abscess. Three said it was easily cured by drainage.

9. Seven, "No." Two, if bulb thrombosed. One thought it might occasionally be necessary, but had not done the operation. Five, when symptoms continue after complete treatment of the vein and sinus. Two, when irrigation fails. Four, when extradural abscess invades jugular fossa.

10. One (only) patient recovered.

The following men answered the above questions: Logan Turner, Edinburgh; W. S. Kerr, Sheffield; D. R. Patterson, Cardiff; Wilfred Clegg, Birmingham; Adair Digton, Liverpool; T. S. Fraser, Edinburgh; T. A. K. Renshaw, Manchester; Harold Mole, Bristol; A. L. Whitehead, Leeds; Sir Robert Woods, Dublin; Albert Grey, Glasgow; George Wilkinson, Sheffield; T. O. Graham, Dublin; McKenzie Booth, Aberdeen; Watson Williams, Bristol; E. M. Stockdale, Liverpool; Constable Hayes, Leeds; W. Permewan, Liverpool; W. T. Clegg, Liverpool; H. A. Ballance, Norwich; W. S. Syme, Glasgow; A. O. Sharp, Leeds; K. W. Monsarrat, Liverpool; Samuel Lodge, Bradford.

**The Labyrinth.** Pike and Wilson<sup>1</sup> presented before the American Otological Society the results of their investigations upon the labyrinth. This is perhaps the most important and authoritative contribution to this complex subject that has appeared from any American investigator. Hampered as we are in our clinical investigations from lack of autopsies, we must turn the more eagerly to the study of the fundamentals of this subject, derived from animal experimentation.

The objects of Pike's and Wilson's investigations, which have extended over a period of six years, were as follows:

1. To study the effect of stimulation of the end organs of the vestibular nerve.

2. To study the immediate and the remote results of destruction of the labyrinth or of the eighth nerve on one or on both sides.

3. To observe the effect of removal of various parts of the brain on phenomena which have been observed to follow stimulation or destruction of the labyrinth.

4. To investigate the paths of connection between the labyrinth and the eye muscles—the vestibular optic path.

5. To apply the results of this experimental work to a consideration of the phenomena of nystagmus, vertigo and the sensation of rotation.

The experiments were carried out chiefly on dogs and cats.

<sup>1</sup> The Relation of the Labyrinth to the Cerebellum and the Cerebrum, by J. Gordon Wilson and F. H. Pike, Transactions American Otology Society, 1914.

The authors first take up a consideration of nystagmus, and divide it into two varieties:

1. Nystagmus (oscillatory nystagmus), a movement of the eyes in all directions from a central point of rest.
2. Nystagmus twitching (alternating nystagmus), when the movement is quicker in one direction.

They classify labyrinthine nystagmus in the latter group, and state that it "consists of two distinct, though associated movements, *viz.*, a slow deviation, followed by a quick return to the primary position." It is divided into these two parts for the following reasons:

1. The slow deviation alone occurs in the earlier stages of an anesthetic. The quick movement only appears as the effect of the anesthetic wears off and the animal regains consciousness.
2. When the anesthetic is pushed, the slow deviation is one of the last cranial reflexes to disappear. It persists nearly or quite as long as the corneal reflex.
3. Bartels has shown that the slow movement alone can be produced by rotation in sleeping children, and that in prematurely born children (seven months) the slow deviation alone can be elicited for some time after birth.
4. By destruction of the cerebrum and thalamus, the quick movement can be eliminated, but the slow persists.<sup>1</sup>

They first studied the results of stimulation of one or both labyrinths with the animal in a definite position, and through a definite opening. They exposed the one bone (labyrinth) through a trephine opening in the mastoid "just posterior to the angle at which the zygomatic process passes anterior from the linea nuchae superior."

The forms of stimulation used were: 1. Mechanical or physical; 2. Electrical—current constant.

TABLE OF RESULTS (DOG).

Stimulation of left labyrinth through trephine wound.		Left eye (deviation).	Right eye (deviation).
Cold water . . . . .		To left and up.	To left and up.
Hot water . . . . .		To right and down.	To right and down.
Electrical, anode; on . . . . .		To left and down.	To left and up.
Electrical, cathode; on . . . . .		To right and up.	To right and down.
Pressure . . . . .		To right and up.	To right and up.
Stimulation of right labyrinth through trephine wound.		Left eye (deviation).	Right eye (deviation).
Cold water . . . . .		To right and up.	To right and up.
Hot water . . . . .		To left and down.	To left and down.
Electrical, anode; on . . . . .		To right and down.	To right and down.
Electrical, cathode; on . . . . .		To left and up.	To left and up.
Stimulation of both labyrinths simultaneously.		Left eye (deviation).	Right eye (deviation).
Left ear.	Right ear.		
Cold water . . . . .	Cold water.	Up.	Up.
Hot water . . . . .	Hot water.	Down.	Down.
Electrical, anode; on . . . . .	Electrical, anode.	No result.	No result.
Electrical, cathode; on . . . . .	Electrical, cathode.	No result.	No result.
Electrical, cathode; on . . . . .	Electrical, anode	To right, down.	To right, down.
Electrical, anode; on . . . . .	Electrical, cathode.	To left, down.	To left, down.

<sup>1</sup> Wilson and Pike, Transactions Royal Philosophical Society, 1912, pp. 127-160.

SUMMARY OF RESULTS. 1. Under an anesthetic a dog shows only a deviation of the eyes, varying with the labyrinth stimulated and with the stimulus employed.

(a) Hot water and the negative pole give the same deviation of the eyes.

(b) Cold water and the positive pole give the same deviation of the eyes.

(c) The deviation produced by the former (a) is in the opposite direction to that of the latter (b).

3. In electrical stimulation of both labyrinths simultaneously, equal electrical stimulation of both sides gives no results. Any inequality of stimulation on the two sides is attended with eye movement away from the side on which the stronger stimulus is applied. The cathode is a stronger stimulus than the anode. Therefore when the cathode is over the left otic bone, as when the left labyrinth only is stimulated with the negative pole, both eyes move to the right.

After destruction of one labyrinth they found that the eyes were "generally speaking," deviated toward the side of the lesion. The nystagmus is typical (see class 2), and is present for some days following the operation. It is synchronous in both eyes, but irregular. This irregularity is most marked for twenty-four hours after the operation. "When the animal comes out of the anesthetic, it is nearly vertical in the eye of the operated side, and horizontal in the eye of the non-operated side." The authors think this irregularity due to "the resultant (a) of the relative overactivity of the opposite labyrinth, and (b) the irritation of the vestibular nerve in the wound."

The following account of the attitude of an animal after destruction of a labyrinth, is interesting, especially in comparison to the behavior of human beings, *i. e.*, the difference is chiefly in torsion of the head and body.

*The General Attitude.* Immediately after the operation the attitude of the animal is very characteristic. After allowing the animal to come out from under the influence of the anesthetic, if it be placed on the floor ventral side downward so that the hind feet are squarely on the floor, there is a torsion of the head to the injured side so that relative to the dorsoventral axis of the body it is inclined about 30 degrees to 45 degrees from the vertical at the shoulders. The injured side of the head lies toward the floor. The head is twisted about 70 degrees to the injured side. On attempting to move, the animal rolls over toward the injured side. The animal is unable to walk, and, if stood upon its feet, will fall over to the injured side.

On succeeding days the animal becomes more steady on its feet, until at the end of a week it seldom falls to one side, and walks in a straight line. At the end of the second week the animal has assumed its permanent attitude. It now stands erect with torsion of the head to

one side, always with the occiput of the injured side twisted downward and forward, and the anterior part of the body inclined somewhat to the injured side.

The effect of removal of the second labyrinth varies somewhat with the length of time after the first operation, but, in general, the effects are less severe the longer the interval between the operations. The head and the anterior part of the body are not twisted to the recently injured side; on the contrary, the head comes nearly, but not quite, back to its normal position and remains there. The nystagmus is present for a few hours but has disappeared by the next day.

Having defined the reactions which follow irritation and destruction of the labyrinth, it becomes necessary to ascertain what influence the cerebellum has on those results. In order to do so the cerebellum was removed partly or entirely, and at a later date the labyrinth was stimulated and destroyed.

The results are given very briefly in the following table, where they are contrasted with labyrinthine removal on the same side. The eye movements may be specially referred to. While the deviation of the eyes in cerebellar lesions, best observed if the dog be at rest, is usually to the right, yet this deviation is inconsistent and varies considerably in the two eyes. The day after the operation it may be to the left in the left eye (operated side) and normal in the right. But the oscillatory movements are distinctly and consistently different in cerebellar and in labyrinthine lesions.

	Left half of cerebellum.	Left labyrinth.
Deviation of eyes	To right.	To left.
Movement of eyes.	Quick oscillations in any plane, especially when disturbed or when an object is looked at.	Slow movement to left with quick return to right (labyrinthine nystagmus).
	If head is turned 90 degrees to left, oscillations are increased.	If head is turned 90 degrees to left, nystagmus is diminished.
	No twitching of M. corrugator supercilii medialis.	Marked twitching of M. corrugator supercilii medialis.
Attitude.	Left pleurosthotonus.	Torsion of head so that occiput is approximated to left shoulder.
	Snout to left.	Snout to right.
	Prefers to lie on right side.	Prefers to lie on left side.
Part affected.	Posterior chiefly.	Anterior chiefly.

THE EFFECT OF LESIONS OF CEREBRUM ON LABYRINTHINE REACTIONS. Removal of a part or of the whole of the cerebellum made it obvious that the deviation of the eyes and the nystagmus resulting from labyrinthine stimulation or destruction *was little, if at all, influenced directly from the cerebellum*, and, further, that the *pathway to the eye nuclei lay outside the cerebellum*. It therefore became necessary to ascertain:

(1) Whether the path from the labyrinth to the eye nuclei is direct by the fasciculus longitudinalis medialis (posterior longitudinal bundle) or whether other higher centres are involved.

(2) Whether removal of various parts of the cortex of the cerebrum changes the labyrinthine effects. Since the quick component in the labyrinthine nystagmus could occur and could be produced only in the conscious state, suggesting a cerebral origin, it was determined to ascertain:

(3) From what portion of the cerebrum the quick component comes.

To accomplish this it was necessary to remove various parts of the cerebrum and either immediately after or at a later date to observe the effects of labyrinthine stimulation or destruction.

The following as well as other experiments were done:

1. Destruction of both occipital lobes of the cerebrum.
2. Destruction of approximately half of the cerebral cortex.
3. Removal of entire cerebral cortex.
4. Complete removal of whole cerebrum with severance of corpora quadrigemina and splitting of cerebellum in the median line.
5. Effect of labyrinthine stimulation and destruction on decerebrated animal.

The results of these experiments may be thus summarized:

Normal results from stimulation of the labyrinth, *i. e.*, *the deviation of the eyes can be obtained when the whole cerebrum and thalami are removed, leaving nothing but pons, medulla, and their connections with the cranial nerves.* The ocular movements in labyrinthine stimulation and after labyrinthine destruction are not merely the spasmodic flickering of a muscle or an inaccurate and impotent movement as of a foot that never hits anything, such as pass for reflex responses in a dog with transacted spinal cord, but full exact movements of normal magnitude.

In all vertebrates so far used for experiment, and particularly in mammals, lesions of the membranous labyrinth of the ear are, without exception, attended by torsion of the anterior part of the body and displacement of the eyes. The torsion of the head is permanent in all these forms except the human. The eye movements alone differ, and these differences are intimately associated with the increasing magnitude and complexity of development of the cerebrum in the vertebrate phylum. The typical results of lesions of the membranous labyrinth, excepting nystagmus, are very largely unaffected by the presence or absence of the phylogenetically newer pathways.

*The greater capacity for adjustment following certain lesions or removals of nervous substance*, inherent in the enormous development of association tracts in the central nervous system of the higher vertebrate, may tend to obscure or mask, because of the completeness of recovery following labyrinthine extirpation, some of the essential features in such a lesion in the higher forms. But the certainty and the severity of the motor

disturbances immediately attending labyrinthine extirpation in the higher mammals is evidence of the persistence of the function of the vestibular mechanism. The more complete recovery in man is not necessarily to be interpreted, as Barany believes, as evidence of the retrogression of the vestibular system in man, but may be regarded as evidence of the *much greater degree of adaptability* on the part of the highly complex zomatic motor system, a point of view widely at variance with Barany's.

Nystagmus occurring in the dog and cat and monkey, as a result of labyrinthine stimulation or destruction, consists of two phases—a slow deviation followed by a quick return—varying definitely in direction with the labyrinth which is stimulated or destroyed. As we have shown, these phases are distinct. Thus the slow deviation is not affected by removal of the cerebellum, nor is it affected by complete removal of the anterior corpora quadrigemina, and longitudinal splitting of the cerebellum. In short, if the anatomical path *from the labyrinth through the vestibular nuclei to the eye nuclei (posterior longitudinal bundle) be intact, the deviation can be produced by stimulation, and appears after destruction so soon as the animal begins to pass out from under the influence of the narcotic.* Deviation appears at a time when the reflex responses of the leg muscles are completely in abeyance, and *pari passu* with the corneal reflex.

The quick phase of nystagmus, though not affected by the removal of the cerebellum or of the greater part of the occipital cortex, is affected by removal of the whole cerebral cortex. It does not occur in animals completely decerebrated, including the optic thalamus, even though the oculovestibular tract be unimpaired. Further, it appears later than the deviation, and can only be produced, or will occur, when the animal emerges from the effect of the anesthetic.

We have attempted in dogs, cats and monkeys to find some region in a hemisphere where a lesion will modify or abolish the nystagmus which follows stimulation or destruction of the labyrinth. In the course of the experiments we have removed the various areas of the cortex, frontal, parietal, occipital and temporal, and have also at times destroyed the subcortical ganglionic masses. Having destroyed these areas, we have then stimulated one or both labyrinths with the electrical current, with hot and with cold water, and by rotation. We have also in many of these cases destroyed one labyrinth either concomitantly with, or subsequent to, the cerebral lesion—a labyrinth either on the side of, or opposite to, the cerebral lesion. We cannot at this time enter into the details of the results, which will be published in full later, *but we desire to state here that the only region where we obtain consistent alteration of the labyrinthine stimulation, and that only so far as the quick component is concerned, is the region of, or adjacent to, the temporal lobe.* In these cases we found that stimulation of the labyrinth on the side

opposite the cerebral lesion with cold water or with the anode, gave typical labyrinthine nystagmus lateral in character, while stimulation with hot water or the cathode gave deviation, but no lateral nystagmus. We also found that destruction of the labyrinth of the side of the cerebral lesion gave no nystagmus. There was further noted, in some of our cases, that the eye on the side of the lesion showed a rotary movement around an anteroposterior axis, while this movement was wanting in the eye of the opposite side.

To sum up, our idea of the mechanism of nystagmus is first an agency somewhere which produces a deviation of the eyes from the primary position of equilibrium or the primary position of the line of fixation of Listing. In labyrinthine nystagmus this agency lies in the labyrinth. The internal rectus muscle on the side of the slow deviation and the external rectus on the opposite side are subjected to a strain greater than usual. This strain, resulting in the stimulation of the sensory or afferent endings of the eye muscles, sets up afferent impulses, which are conveyed to the cerebrum along the afferent fibres in the third, fourth, and sixth cranial nerves (Tozer and Sherrington, *Proc. Roy. Soc.*, 1910, p. 450). These afferent impulses in their turn set up efferent impulses in the oculomotor cells of the cerebrum, which result in a quick jerky contraction of the internal rectus on the side of the slow deviation, and of the external rectus of the opposite side, with relaxation of the antagonistic muscles. The effect is a restoration of the eyes to the primary position. The eyes do not go beyond this median position when the cerebrum is intact, since the afferent impulses to contraction of the external and internal rectus muscles concerned cease when the eyes reach this position of equilibrium.

Lesions of the cerebral hemisphere on the side of the slow deviation of the eyes abolish or reduce the quick component, since it is from the hemisphere of this side that the efferent impulses concerned in the pulling of the eyes back to the median line arise.

**Congenital Bilateral Microtia.** Page reports a case of congenital bilateral microtia upon which he operated with good result.<sup>1</sup>

He says that general opinion is against operation in these cases for the following reasons:

"First, that where the external ear is deformed and the meatus congenitally occluded, there invariably exists such an extensive defect, either in the conducting mechanism or in the perceptive apparatus, or both, that operation is unwarranted.

"Second, that the operation should not be performed unless tuning fork and bone tests are found to indicate a functioning labyrinth.

"Third, that it is practically impossible to prevent closure of an artificial canal after it has been made."

<sup>1</sup> Transactions American Otological Society, 1914, p. 376.

Page shows, however, that in the development of the temporal bone, the labyrinth is of different origin, and develops independently of the meatus and auricle. He says: "It can be definitely stated then, that cases of defective development of the internal ear, are rarely, if ever, found to be associated with atresia of the canals in otherwise well-developed infants."

*Page's Case.* One of bilateral congenital microtia with atresia, now five years of age, has been under my observation since he was seven weeks old. Tuning fork and bone conduction tests were of no use, but as whistling on one's fingers easily demonstrated the presence of hearing, as did tests with the voice, his right ear was operated on when he was two years of age.

The x-ray revealed an antrum and tympanum with what looked to be ossicles present on both sides, and mastoids of fair size.

The usual curved incision was made behind the rudimentary auricle, and, when that was displaced forward, no evidence of bony meatus was found except a barely noticeable depression, or rather unevenness, in the bone at the point where the meatus might have been expected to be. The cortex of the mastoid was removed and every cell beneath it was found filled with thick muco-purulent fluid, though there was no external sign to indicate the presence of such a condition, the child's temperature being normal. A fairly large antrum was found and from this a small aditus leading to a contracted middle ear. All were filled with the same muco-purulent fluid. Being impressed with the difficulty of keeping open a canal down to the aditus, he determined to invade the tympanum and get as large an exposure of its internal wall as possible. The bone corresponding to the location of the meatus was cut down to the aditus, making a large single cavity in the bone. No evidence of fibrous canal, or drum-membrane, or annulus was found. In removing the bone from along the line of what should have been a bony canal, a hard tubular line of bone was encountered external to the horizontal semi-circular canal, and it was at first thought to be the aqueductus falopii, despite its faulty position. More bone was removed, however, and it was found to be the edge of a rudimentary incus which was imbedded in the bone. No evidence of a membrane, or of the other two ossicles was discovered. I am confident, however, that a stapes was present, although I was unable to definitely see it on account of the bleeding, and the overhanging facial ridge which prudence forbade my lowering to the extent it might have been lowered in a less abnormal case. The middle ear was a narrow, slit-like cavity from without inward, but fairly wide from the orifice of the Eustachian tube back to the aditus and from above downward. The Eustachian tube was patent and the tympanum was lined with membrane continuous with that of the tube, and the whole cavity was filled with the same muco-purulent fluid that was in the antrum and cortical cells. A large

meatus nearly two centimeters in diameter was cut in the rudimentary auricle, the skin being turned in as far as possible in order to retain it, as there was no cartilage to give it support. The posterior incision was closed and the cavity was skin grafted ten days later. A caloric test after the operation was markedly positive within a few seconds.

Two years later the meatus was about 5 millimeters in diameter and easily admitted a speculum of moderate size without stretching. The interior of the cavity was clean, white and dry—a medium-sized radical cavity.

Because of the easily apparent improvement in the child's hearing, the mother was anxious to have his other ear operated on, as he was then becoming more attentive and had begun to form a few short sentences of simple words.

The same procedure was followed in the second as in the first operation. Examination revealed no evidence of a meatus, or a bony canal. No pus was found in the cells, as there had been on the opposite side. An annulus-tympanicus was found and what appeared to be an indefinite web-like drum-membrane, also a poorly formed malleus. The tympanum was itself wider than the one on the opposite side and contained, in addition to the undeveloped malleus, a well formed incus and, as was afterward demonstrated, a stapes.

In forming the meatus a large crucial incision was made, the four flaps of skin were dissected up and reflected, and a very large opening in the soft parts was formed. The flaps were then drawn well in over the edges of the newly constructed meatus, and held in position with sutures. The posterior wound was sutured throughout, and ten days later the interior of the cavity was grafted with Thiersch grafts. Caloric test performed later gave a positive reaction within a few seconds.

His mother, in a letter dated April 24, 1914 (three years after the first operation, and a year and a half after the second), states that she speaks to him in the same natural tone of voice she uses for the other children, and he answers promptly. When she calls to him from an adjoining room he replies readily. He imitates different animals, and called her attention a short time ago to the croaking of frogs some distance off. Is bright and talks remarkably well.

Page's conclusions are: "That operation is warranted in practically every case of congenital bilateral microtia with total osseous atresia which occurs in *an otherwise well formed infant*; that when the child has reached the age of two years and his attention can be attracted by sounds through the air, such as whistles, calls, etc., x-ray photographs should be made (under anesthesia), and operation should be performed through the mastoid posterior to the line of the canal. The antrum should be opened and, unless a normal drum-membrane is found, the contents of the tympanus with the exception of the stapes should be entirely removed and a large exposure of the inner tympanic wall

obtained. Injury to the jaw can be avoided by working from the antrum forward. The Eustachian tube, if present, should be closed by curetting. The secret of success depends on the allowance for cicatricial contraction in the soft parts and the construction of a large radical cavity in the bone. It is of the utmost importance to control the formation of thick connective tissue in the cavity, so within a week or ten days it should be grafted, and if for any reason failure of the grafts should occur, a second or even third attempt to obtain rapid dermatization should be made without delay. The possibility of affording the child improvement of hearing at the critical period necessary for the easy development of speech warrants the early operation."

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